R. L. Bancal
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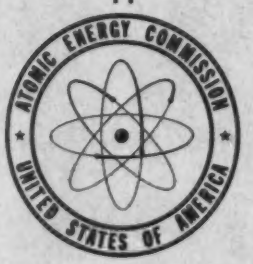
UNITED STATES ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts

Volume 11 No. 20 Supplement
Abstracts 11555 - 11829
October 31, 1957



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NORTH CAROLINA
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Replacement Page to be Inserted in NSA Vol. 11 No. 16.

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A listing of abstract numbers corresponding to the numbers of the reports included in this issue.

ASSIGNED CODE DESIGNATIONS

AECD

To declassified reports released by the Atomic Energy Commission after February 29, 1948 (appeared in April 15, *Nuclear Science Abstracts*).

AECU

To unclassified reports originating within the Atomic Energy Project. (Subsequent to AECU-871, this code is applied only to reports carrying no other recognized code designation.)

NP

A file designation assigned by the Technical Information Service Extension (TISE) to nonproject reports whose codes, if present, are not practical for TISE use.

TID

To classified Atomic Energy Project reports not supplied with satisfactory report numbers by the originator (appearing in this list because of subsequent declassification and release by the Atomic Energy Commission) and to all reports originating with the Technical Information Service of the AEC.

Other code designations are assigned to unclassified reports by the originating installations.

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NUCLEAR SCIENCE ABSTRACTS

A Publication of the United States Atomic Energy Commission Technical Information Service Extension.

The printing of this publication has been approved by the Bureau of the Budget, July 30, 1957.

INTRODUCTION

SCOPE

Nuclear Science Abstracts (NSA) is intended primarily to serve scientists and engineers working within the Atomic Energy Project by abstracting as completely and as promptly as possible the literature of nuclear science and engineering. It covers not only unclassified and declassified research reports of the AEC and its contractors, but also material in its field of interest which appears in unpublished research reports of government agencies, universities, and industrial research establishments, and in the technical and scientific journals.

INDEXES

Nuclear Science Abstracts is indexed by personal and corporate author, by subject, and by report number. Annual index issues are prepared for each volume. A cumulated index to Vols. 1–4 was issued as Vol. 4, No. 24B, Dec. 30, 1950.

AVAILABILITY

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NUCLEAR SCIENCE ABSTRACTS

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GENERAL

RESEARCH PROGRAMS

11555 CF-56-3-44
Oak Ridge National Lab., Tenn.
REACTOR PHYSICS AT ORNL (TRIPARTITE CONFERENCE ON NUCLEAR CONSTANTS, CHALK RIVER, JAN. 10–12, 1956). Robert A. Charpie. Mar. 7, 1956. 5p. $1.80(ph OTS); $1.80(mf OTS).

Research programs at ORNL in experimental and theoretical reactor physics are briefly reviewed. No technical data are included. (C.H.)

BIOLOGY AND MEDICINE

11556 HW-42403
Hanford Atomic Products Operation, Richland, Wash.
RADIOLOGICAL SCIENCES DEPARTMENT RESEARCH AND DEVELOPMENT ACTIVITIES QUARTERLY PROGRESS REPORT [FOR] JANUARY–MARCH 1956. H. M. Parker. Apr. 13, 1956. Decl. Mar. 6, 1957. 33p. Contract W-31-109-Eng-52. $0.40(OTS).

Progress is reported in the following studies: a radiobiological-ecological survey of the Columbia River; the toxicity of sodium dichromate in effluent water for chinook salmon; the toxic effects of continuous low-level exposure to I^{131} in sheep; comparative effects of β irradiation on the skin of sheep, swine, and rabbits; fission product absorption and metabolism in rats; absorption and metabolism of reactor effluent radioisotopes in rats; gastro-intestinal radiation injury in rats; fission product uptake in plants; genetic effects of internally deposited radioelements in yeast; biological monitoring of waterfowl; development of a system for the quantitative measurement by γ counting of fission products in reactor effluent; the development of monitoring methods and instruments; counting techniques; soil chemistry; waste disposal; and meteorological studies. The status of the research program is reviewed. (For preceding period see HW-41026.) (C.H.)

RADIATION EFFECTS

11557 CF-56-8-86
Oak Ridge National Lab., Tenn.
OAK RIDGE NATIONAL LABORATORY PROPOSAL FOR MAMMALIAN RADIATION INJURY AND PROTECTION FACILITIES. Aug. 20, 1956. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Facilities for housing mice used in radiation injury and protection studies were surveyed. It was concluded that more room was needed. (C.H.)

RADIATION HAZARDS AND PROTECTION

11558 ORNL-1982
Oak Ridge National Lab., Tenn.
RELATIVE BIOLOGICAL HAZARDS OF RADIATIONS EXPECTED IN HOMOGENEOUS REACTORS TBR AND HPR. E. D. Arnold and A. T. Gresky. Dec. 2, 1955. Decl. Mar. 12, 1957. 55p. Contract W-7405-eng-26. $0.45(OTS).

An evaluation of the relative health hazards of radioisotopes produced in nuclear reactors is reported. The most important hazards were indicated to be I^{131}, the Sr^{90}-Y^{90} chain, the Ce^{144}-Pr^{144} chain, Sr^{89}, the Ba^{140}-La^{140} chain, Y^{91}, the Zr^{95}-Nb^{95} chain, Pr^{143}, La^{140}, and Pa^{233}. The most critical body organs affected by air-borne contamination are the thyroid gland, the bone marrow, the lungs, and the gastrointestinal tract. Where possible, continuous daily removal of gaseous and solid fission products from the reactor environment can be shown to permit very significant reductions in the total hazards. Homogeneous reactors, such as the Thermal Breeder Reactor and the Homogeneous Plutonium Producer Reactor, specifically studied in this report, are designed with daily removal cycles and may be considered potentially safer than heterogeneous reactors. (auth)

11559 Y-780
Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.
HEALTH PHYSICS PROGRESS REPORT [FOR] NOVEMBER 1, 1950–DECEMBER 31, 1950. E. G. Struxness. June 14, 1951. Decl. Mar. 7, 1957. 41p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

Progress is reported on the following: studies of external radiation hazards; studies of internal radiation hazards from handling and processing U and the separation of isotopes of Pu; routine health physics monitoring surveys; the development of radiation detection instruments for use in monitoring; and industrial hygiene activities associated with the handling of Be, Hg, turpentine, and liquid metals. (C.H.)

11560 Y-897
Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.
POTENTIAL HAZARDS OF CRITICALITY ACCIDENTS. C. L. Schuske. Aug. 5, 1952. Decl. Jan. 17, 1957. 9p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

Accidental accumulations of super-critical masses of fissionable materials have resulted in radiation bursts ranging from a little less than 0.1 megawatt to more than 15 megawatts. The lethal radii for bursts of 0.1 megawatt 3 and 15 megawatts are calculated to be approximately $1\frac{1}{2}$, $9\frac{1}{2}$, and 22 feet, respectively. These calculations are based on the assumption that 400 roentgens of gamma or gamma equivalent radiation is lethal to 50% of the population. Although the residual radiation from the fission fragments is large, operating personnel outside of the lethal circle can remain in the contaminated area for as long as 20 to 30 sec. without adding significantly to their over-all exposure. For an accident of about 0.1 megawatt, probably less than 7 additional roentgens will be received by remaining in the contaminated area for 20 sec. The additional radiation would be proportionally higher for bursts of from 3 to 15 megawatts. These approximations do not include the health hazard of ingested beta and alpha-active contaminants, which might be present in the air after a burst. Process monitors with a sensitivity of .014 r/hr. such as used at Y-12 are more than adequate for full coverage of all likely bursts when placed on 100 foot centers. (auth)

CHEMISTRY

11561 A-2364

[Standard Oil Co. of Indiana, Chicago.]

CONCERNING SOME ISOTOPIC EXCHANGE REACTIONS OF BORON COMPOUNDS. A. N. Webb and W. L. Rittschof. Oct. 30, 1945. Decl. Mar. 12, 1957. 19p. Contract W-7418-eng-41. $3.30(ph OTS); $2.40(mf OTS).

The isotopic exchange between boron atoms of the $(CH_3)_2O-BF_3$ complex and those of B-containing impurities was shown to be rapid and complete under the experimental conditions. It was also demonstrated that the exchange of B atoms within the $(CH_3O)_3B-BF_3$ molecule is rapid even at room temperature. (C.W.H.)

11562 ANL-4258(Del.)

Argonne National Lab., Lemont, Ill.

CHEMISTRY DIVISION, SECTION C-11 SUMMARY REPORT FOR JULY, AUGUST, AND SEPTEMBER 1948. May 11, 1949. Decl. with deletions Feb. 18, 1957. 81p. Contract W-31-109-eng-38. $13.80(ph OTS); $4.80(mf OTS).

11563 ANL-4942(Del.)

Argonne National Lab., Lemont, Ill.

CHEMISTRY DIVISION, SECTION C-I SUMMARY REPORT [FOR] APRIL, MAY, AND JUNE, 1952. D. W. Osborne, ed. Aug. 1, 1952. Decl. with deletions Feb. 12, 1957. 64p. Contract W-31-109-eng-38. $10.80 (ph OTS); $3.90(mf OTS).

Progress is reported on the following studies: radiations and half life of Pu^{243}, neutron capture cross section of Pu^{242} relative photo-fission and photo-neutron emission cross sections of U^{238}, quantitative O_2 recovery from U oxides and $BiPO_4$, dielectric constant of BrF_5, vapor density of HF solubility of Pu in BrF_3, O_2 exchange between UO_2Cl_2 and H_2O, heats of formation of UH_3, UD_3, and UT_3, entropy, heat capacity, and enthalpy of ThF_4 from 5 to 300°K, heats of solution of $CoCl_2$ hydrates and pyridenates and the binding energies of water and pyridine, vapor pressure of $NpCl_4$, some properties of Fe biscyclopentodienyl, solvent extraction of Am, Cm, and Pm, oxidation of Am, alkyl and aryl phosphates and phosphites as extractants for various lanthanides and actinides, partition of Zn between aqueous HCl and tri-n-butylorthophosphate, and thermal measurements in He^3-He^4 mixtures. (W.L.H.)

11564 ANL-5411(Del.)

Argonne National Lab., Lemont, Ill.

CHEMISTRY DIVISION SUMMARY REPORT [FOR] JANUARY TO JUNE 1953. J. R. Gilbreath, D. W. Osborne, and A. F. Martin, comps. Mar. 29, 1955. Decl. with deletions Feb. 11, 1957. 47p. Contract W-31-109-eng-38. $7.80(ph OTS); $3.30(mf OTS).

Fast neutron cross sections are reported for Pa^{231}, Th^{232}, U^{233}, U^{234}, U^{235}, U^{236}, U^{238}, Np^{237}, and Pu^{239}. The relative fission cross sections of U^{235}, Pu^{239}, and U^{233} in the CP-3' reactor were determined. The effects of pile irradiations on the properties of graphite, diamond, and quartz were investigated. The decomposition of formic acid-oxygen systems by the $B^{10}(n,\alpha)Li^7$ reaction and by U^{235} fission recoils was studied. The oxidation of Fe^{2+} in $FeSO_4$ by U^{235} fission recoils and H^3 betas was also studied. Encouraging results were obtained for the recovery of U from MgF_2 slags. A study of UO_2 slurries in NaK was initiated. The reaction of PuF_4 and BrF_3 was studied as a means of improving Pu recovery in the Fluoride Volatility Process. A new procedure is outlined for the determination of C in U. (C.W.H.)

11565 ANL-SL-SL-1039

Argonne National Lab., Lemont, Ill.

COMMENTS ON "APPLICATION OF FLUIDIZATION TO NUCLEAR TECHNOLOGY." Ju Chin Chu. Apr. 4, 1956. Decl. Mar. 16, 1957. 52p. Contract [W-31-109-eng-38]. $9.30(ph OTS); $3.60(mf OTS).

The preparation of UO_3 with high reactivity towards hydrofluorination is described. The reaction rate is correlated with process conditions and physical characteristics of the system for conversion of UO_3 to UF_6. Design data are developed for multiple stage fluidization, and the volume of fluidized bed is determined. Heat transfer coefficients of submerged surface in a fluidized bed are determined. Uniform distribution of fluidizing gas is predicted by pressure drop and solid-flow gradient calculation. The calcination of radioactive waste by fluidization with steam is reported. A process recommendation is made for production of UF_4 by fluidizing UO_3 with gaseous NH_3 and HF. The energy balance in a fluidized reactor is derived. (L.T.W.)

11566 CC-918

Chicago. Univ. Metallurgical Lab.

CHEMICAL RESEARCH—RADIATION CHEMISTRY REPORT FOR MONTH ENDING SEPTEMBER 11, 1943. Decl. Feb. 18, 1957. 27p. (A-1323). $4.80(ph OTS); $2.70 (mf OTS).

A study of the effect of radiation on benzene and other organic compounds is presented. Additional data for the change of Young's Modulus and electrical resistance of AGOT graphite with neutron bombardment continue to show a trend toward saturation. Several additional samples of optical glass as well as various types of light bulbs were subjected to x radiation. The radiation corrosion of Al is given. The solubility of NO and Xe in various solutions is discussed. (W.L.H.)

11567 CF-55-1-194(Del.)

Oak Ridge National Lab., Tenn.

UNIT OPERATIONS STATUS REPORT FOR JANUARY 1955. W. K. Eister. Jan. 28, 1955. Decl. Mar. 7, 1957. 50p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30 (mf OTS).

Continuous U dissolving equipment has been installed. Bench-scale dissolution tests with 2S extruded Al in HNO_3 containing $Hg(NO_3)_2$ were carried out. Work is being continued on Excer-moving bed studies. Recovery of U from ore pulp containing less than 200-mesh solids in a Higgins continuous ion exchange equipment was unsatisfactory. The PDA Amalgam exchange in the Metallex Process has been carried out on a 2-kg batch scale. The results of corrosion studies of permalloy powder are discussed. The A and B loop of the homogeneous reactor fuel reprocessing section are discussed. Miscellaneous data are included. (W.L.H.)

11568 HW-26517

Hanford Works, Richland, Wash.

NITRATION REACTIONS OF SHELL SPRAY BASE UNDER PUREX WASTE RECOVERY PROCESS CONDITIONS. R. M. Wagner. Dec. 5, 1952. Decl. Mar. 4, 1957. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Experiments were performed to characterize the types of nitro compounds that might be formed by reaction of Shell Spray Base with nitric acid, to determine the extent of their formation, if any, and their path under conditions of nitric acid recovery in the Purex Process. It is concluded that the instability of Shell Spray Base to nitration, under conditions to prevail in the plant, presents neither a disposal problem nor a safety problem. (auth)

11569 KAPL-M-EDL-100

Knolls Atomic Power Lab., Schenectady, N. Y.

NaK FLUSHING OF SODIUM-CONTAMINATED TEST EQUIPMENT. P. E. Bissonnette. July 1, 1955. 15p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Sodium-potassium flushing was tested in order to determine its efficacy in removing Na from a test fixture after testing. It was determined that the use of this method facilitates disassembly of the test fixture. (auth)

11570 KLX-1211
Kellex Corp., New York.
SOLVENT EVALUATION FOR LIQUID-LIQUID EXTRACTION (23-F). Closing Report. Jan. 15, 1951. Decl. Mar. 28, 1957. 19p. Contract AT(30-1)-848. $0.30(OTS).

Comparison of diethyl ether, TBP–kerosene, hexone, dibutyl carbitol, and pentaether as alternative solvents for U extraction in the MCW refining process was made using a Scheibel column for extraction and a packed column for scrubbing and stripping. TBP–kerosene, 15 and 30%, gives high U extraction efficiencies, produces a product of the highest purity among the solvents tested, and has good operability from a physical and mechanical view point. (auth)

11571 KLX-1226(Del.)
Vitro Corp. of America, New York.
METAL NITRATE CONVERSION — PROJECT SUMMATION. Period [covered] December 1951 – May 1952. Job 23-L. June 25, 1952. Decl. with deletions Feb. 28, 1957. 40p. Contract AT(30-1)-848. $6.30(ph OTS); $3.00(mf OTS).

Work done on the development of a process for the production of metal grade ThF_4 from mantle grade $Th(NO_3)_4$ is summarized, chemical and design data on the developed wet process are given. Steps in the process are precipitation of ThF_4 from aqueous $Th(NO_3)_4$ solutions by HF, filtration and washing of the ThF_4, forced-convection air-drying of the ThF_4, and dehydration of the dried ThF_4 in either a N_2 or an anhydrous HF atmosphere at elevated temperatures. (auth)

11572 KLX-10029
Vitro Labs., West Orange, N. J.
ELECTROKINETIC PROCESSES — NUCLEAR ASPECTS. Quarterly Progress Report [for] February 1, 1956 – April 30, 1956. Dept. of Chemical Research and Development. Vitro Job 2018. H. F. Reichard, H. G. Scheible, M. Kibrick, and H. Katz. May 15, 1956. Decl. Feb. 27, 1957. 14p. Contract AT(30-1)-850. $0.30(OTS).

Optimum coating green strengths and deposition rates were obtained with 3% zein as activator and binder in electrophoretic dispersions. Coating reproducibility studies were made with NiO and Fe_3O_4 dispersions in a specially constructed cell; coatings were reproduced to better than 5%. Studies on zein-activated NiO dispersions showed no appreciable decrease in deposition rate after 14 days of aging. (auth)

11573 KLX-10041
Vitro Labs., West Orange, N. J.
ELECTROKINETIC PROCESSES — NUCLEAR ASPECTS. Quarterly Progress Report [for] May 1, 1956 – July 31, 1956. Dept. of Chemical Research and Development. Vitro Job 2018. H. F. Reichard, H. G. Scheible, and M. Kibrick. Aug. 15, 1956. Decl. Feb. 25, 1957. 11p. Contract AT(30-1)-850. $0.25(OTS).

Electrophoretically deposited W coatings were carbided in CO and gave Knoop hardness numbers at 100 g of up to 1300. Alumina was applied to graphite and fired at 1800°C, but the adherence and sintering of the resultant coatings were not satisfactory. Nickel coatings were deposited on thin Fe undercoats bonded to graphite; the coatings sintered well but developed some shrinkage cracks. (auth)

11574 ORNL-1116
Oak Ridge National Lab., Tenn.
CHEMISTRY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1951. Feb. 14, 1952. Decl. Mar. 2, 1957. 93p. Contract W-7405-eng-26. $13.80(ph OTS); $4.80(mf OTS).

Chemistry of source, fissionable, and structural Elements. Freezing point and conductivity studies of UO_2F_2 in aqueous solutions are described. The negative complexing of anion exchange resins with chloride ions was determined by studying resin adsorption of cations. High-level separation of Tc from solvent-extraction raffinaites is discussed. The γ-ray spectrum of Tc^{100} produced by $Mo^{100}(d,2m)$ was observed. Nuclear Chemistry. Nuclear spin and quadrupole moment of 4.4×10^5 year Cl^{36} was determined. An improvement in neutron diffraction techniques for low symmetry structure determinations is given. The kinetics of Br_2-BrO_3 isotopic exchange reaction in acid solution was examined. Radio-Organic Chemistry. The effects of γ radiation from 300-curie Co^{60} source upon aqueous solutions of C^{14}-labeled benzoic and acetic acids was studied. Radiation effects on aqueous carboryl-labeled benzoic acid is described. Synthesis of high, low, and intermediate molecular weight compound containing C^{14} is described. Chemistry of Separation Processes. Work is in progress on the removal of Pa^{233} from neutron-irradiated ThF_4. The solubility of TBP and rate of hydrolysis was studied. Chemical Physics. The first experiments with the x-ray-diffraction apparatus are described. Results of thermodynamic computations on reactions of metals with NaOH were tabulated. Reactor Chemistry. Conductivity measurements of aqueous solutions of U salts will be made between 100 and 300°C. Studies of corrosion and solution stability was continued both in and out of the pile. Solubilities of $La(SO_4)_3$ and $Ce(SO_4)_3$ in H_2O was determined up to 350°C. Radiation Chemistry. The value $G = 15.5 \pm 0.3$ Fe^{2+} oxidized per 100ev was confirmed using new calorimetric measurements of γ-ray energy at intensities of 1500, 4500, and 15,000 r/min. The yield for reduction of Ce^4 in air-saturated 0.4M H_2SO_4 is 2.46 Ce^{4+} reduced per 100ev. A new method was used for the determination of phenol in dilute aqueous solution which is not interfered with by benzene or H_2O_2. (W.L.H.)

11575 ORNL-2014
Oak Ridge National Lab., Tenn.
METHODS OF ANALYSIS OF ANISOLE–BF_3 SOLUTIONS. H. P. House, J. R. Lund, J. R. French, A. S. Meyer, Jr., E. C. Lynn, L. J. Brady, J. L. Mottern, and C. D. Susano. Jan. 11, 1956. Decl. Mar. 2, 1957. 27p. Contract W-7405-eng-26. $0.35(OTS).

Procedures are presented for the determination of B, Fe, and Cu in anisole solutions of BF_3 and for the determination of total F^-, total B, and BF_3 hydrolysis products in aqueous BF_3 solutions. (C.W.H.)

11576 ORNL-2046
Oak Ridge National Lab., Tenn.
CHEMISTRY DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 20, 1955. Apr. 13, 1956. Decl. Mar. 2, 1957. 94p. Contract W-7405-eng-26. $0.60(OTS).

Inorganic and Physical Chemistry. Anion exchange studies of metal complexes with organic strong-base exchangers continued. The solubility of Ag_2SO_4 has been determined in H_2O and in H_2SO_4 at temperatures up to 250°C. The effects of MoO_4^{2-}, WO_4^{2-}, CrO_4^{2-} and TcO_4^- on the electrode potential of Fe and the effects of Cu^{2+} on the electrochemical behavior of stainless steel were studied. The heat capacity of Re_2O_7 between 15 and 300°K was determined. Electrical conductance and density data were obtained for alkali metal halides as functions of temperature. Self-diffusion coefficients were measured of Na^+ and NO_3^- in fused $NaNO_3$ to 375°C. Phase equilibria and electrical conductivities of K–KCl systems are reported. Nuclear

Chemistry. Decay properties and schemes are presented for Ce^{139}, La^{137}, Ce^{137}, Rb^{89}, $Ca^{49}-Sc^{49}-Ti^{49}$, and Tc^{101}. Organic Chemistry. The rearrangement of diphenyl-p-tolylacetaldehyde-1-C^{14} and 1,2-diphenyl-1-p-tolylethylene glycol in acid solutions was studied. The kinetics of the triphenylethylene glycol rearrangement and the reactions of benzyl-type Grignard reagents were investigated. Chemical Physics. The effects of pressure on pure quadrupole resonance frequencies in chlorates were studied. Paramagnetic resonances of hydrazyl, $Ca(OH)_2$, and ice were observed. An O-H distance of 0.980 ± 0.002 A was found in $Ca(OH)_2$ by neutron diffraction measurements. Chemistry of Separation Processes. Fundamental studies were continued on ion-exchange resins. The solvent properties and pyrolysis of butyl phosphates were investigated. A tetrabutyl pentamethylenediphosphine dioxide, which may possibly be used as a solvent, was synthesized. Neptunium recovery from Purex wastes was studied. Radiation Chemistry. Radiation effects on the decomposition of acetylene and benzene, $Ce^{4+}-Tl^{+}$ reaction, $Cr_2O_7^{2-}$ reactions with Br and Tl^{+}, decomposition of TBP, and physical properties of $Th(NO_3)_4$ solutions were studied. Reactor Chemistry. Phase studies were continued on the $Li_2O-UO_3-CO_2-H_2O$ system at 250°C. (For preceding period see ORNL-1940.) (C.W.H.)

11577 ORNL-2069
Oak Ridge National Lab., Tenn.
THE ANCO SYSTEM FOR BORON ISOTOPE ENRICHMENT. Progress Report for Period Ending September 20, 1955. R. M. Healy, E. F. Joseph, and A. A. Palko. May 1, 1956. Decl. Mar. 2, 1957. 49p. Contract W-7405-eng-26. $0.45(OTS).

A new gas-liquid countercurrent system (the ANCO system from ANisole-COmplex) for the enrichment of boron isotopes was developed. The system utilizes the exchange reaction between BF_3 (gas) and BF_3 · anisole(liquid) to concentrate B^{10} in the liquid phase. The single stage isotopic separation factor for this system was found to vary from 1.039 at 0°C to 1.029 at 30°C. The isotopic exchange reaction was shown to be rapid. Vapor pressures of the complex as a function of temperature were measured and the heat of formation of the complex determined. Laboratory experiments show that quantitative removal of the BF_3 from the complex can be accomplished by heating. Based upon the experience obtained with the laboratory ANCO unit, a pilot plant large enough to utilize a 6-inch diameter exchange column was designed. The design calculations of the major pieces of equipment are presented. (auth)

11578 Y-585(Del.)
Oak Ridge National Lab., Y-12 Area, Tenn.
Y-12 CHEMICAL RESEARCH DIVISION PROGRESS REPORT [FOR] JANUARY 1, 1950 TO MARCH 31, 1950. G. H. Clewett. Apr. 20, 1950. Decl. with deletions Mar. 6, 1957. 80p. Contract W-7405-eng-26. $12.30(ph OTS); $4.50(mf OTS).

Progress is reported on the following studies: separation of Hf from Zr; purification of Zr; preparation of pure Hf; preparation of $ZrCl_4$; electrodeposition of Zr; U metal reduction; VF_3 preparation, reactor chemistry; and miscellaneous studies. (W.L.H.)

ANALYTICAL PROCEDURES

11579 A-2367
[Standard Oil Co. of Indiana, Chicago.]
DETERMINATION OF THE BORON ISOTOPE OF MASS TEN BY THE NEUTRON ABSORPTION COUNTER METHOD. C. M. Judson. June 14, 1946. Decl. Mar. 12, 1957. 54p. Contract W-7418-eng-41. $9.30(ph OTS); $3.60(mf OTS).

A description is given of a procedure for determining the concentrations of the light isotope of boron by measuring with a neutron counter the absorption of slow neutrons by solutions of boron. This procedure was used for the routine determination of boron isotope abundances to obtain the control data necessary for the operation of a fractionation unit used to separate the boron isotopes. The apparatus used for these measurements is described together with the analytical procedures which were followed. The problems and difficulties encountered in the operation of the counter are presented, along with steps taken to modify the experimental technique so as to reduce the errors to a minimum. Known sources of error are discussed in detail, and the other possible sources of error are considered. The random statistical errors of the counter measurements are calculated for various conditions A comparison is made between this method and the mass spectrometer method of determining boron isotopes. For the routine control needed at this laboratory, the counter had definite advantages over the mass spectrometer. Further improvements in the method of analysis are considered. (auth)

11580 CF-55-7-103
Oak Ridge National Lab., Tenn.
DETERMINATION OF IRON(III) IN MIXTURES OF ALKALI METAL FLUORIDE SALTS. J. C. White. July 22, 1955. Decl. Mar. 12, 1957. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A method which is based on the absorption of the ferric phosphate complex in the ultraviolet has been developed for the determination of Fe^{3+} in the presence of Fe^{2+} in mixtures of alkali metal fluoride salts. Iron(III) in concentrations of 1 to 5 μg/ml in 0.5M H_2SO_4 and 1M H_3PO_4 solution may be determined accurately by observing the absorbance at 260 mμ. Alkali metals, Ni^{2+}, Cr^{3+}, Fe^{2+} and fluorides do not interfere, however Zr and U interfere seriously. (auth)

11581 CF-56-4-171
Oak Ridge National Lab., Tenn.
REVIEW OF HRT-CORE PROCESSING PLANT DESIGN. R. E. Blanco, H. K. Jackson, W. H. Lewis, E. L. Nicholson, and J. W. Ullmann. Apr. 26, 1956. Decl. Mar. 14, 1957. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

11582 CF-56-5-17
Oak Ridge National Lab., Tenn.
TRIP REPORT ON THE SYMPOSIUM ON THERMOGRAVIMETRY AND DIFFERENTIAL THERMAL ANALYSIS HELD IN DALLAS, TEXAS, APRIL 10, 1956, IN CONJUNCTION WITH THE ACS CONVENTION. L. M. Ferris. May 1, 1956. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

11583 HW-19300
Hanford Works, Richland, Wash.
X-RAY PHOTOMETRIC DETERMINATION OF URANIUM IN METAL OXIDES. M. C. Lambert and D. C. Bixby. Nov. 6, 1950. Decl. Mar. 30, 1957. 13p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

Procedures have been developed for the satisfactory determination of U in metal oxide materials with the x-ray photometer. Extraction with TBP is employed to separate U from appreciable amounts of extraneous substances. Uranium determinations for a series of six samples can be completed by the photometric method in 1.75 to 2.0 hr. This is roughly one-fourth of the time required by a method in

current use. A single sample can be analyzed in 45 min. Precision of the photometric U determinations, at the 99% confidence limits, is estimated at ± 0.77%, absolute. It has been shown that HNO_3 alone will dissolve all the U in metal oxide samples and that it is not necessary to use aqua regia. Recommended procedures are outlined. (D.E.B.)

11584 HW-27162
Hanford Works, Richland, Wash.
THE ANALYSIS OF TBP PROCESS STREAMS FOR CALCIUM WITH THE FLAME PHOTOMETER. D. W. Brite. Feb. 20, 1953. Decl. Feb. 6, 1957. 4p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

11585 KAPL-890(Rev.)
Knolls Atomic Power Lab., Schenectady, N. Y.
SELECTED ANALYTICAL METHODS FOR PUREX PROCESS CONTROL. B. F. Rider—E. L. Bernier, ed. Apr. 30, 1953. Decl. Mar. 14, 1957. 142p. Contract W-31-109-Eng-52. $0.80(OTS).

Step-by-step procedures used for control of the Purex process pilot plant at KAPL are given for use as a laboratory manual. Included are procedures for measuring acidity; for measuring density; for determining Pu; radiation measurements of α, β, and γ; radiochemical procedures for Am^{241} plus Cm^{242}, Ce^{144}, Cs^{137}, I^{131}, Np^{237}, Nb^{95}, Ru^{106}, Sr^{89}, Th^{234}, total rare earths, Zr^{95}, and total fission products; and U. Miscellaneous determinations include Al, C_4H_9OH, DBP, Fe^{3+} and Fe^{2+}, F^-, H_2O_2, $C_6H_4(OH)_2$, NH_2OH, MnO_2, Mn, NO_2^-, PO_4^-, Na, $NaNO_3$, sulfamate, SO_4^{2-}, TBP, and H_2O. Also included in the Appendix are safety rules and some laboratory techniques. (auth)

11586 ORNL-1788(Rev.)
Oak Ridge National Lab., Tenn.
ANALYTICAL CHEMISTRY DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING OCTOBER 20, 1954. Jan. 3, 1955. Decl. Mar. 1, 1957. 57p. Contract W-7405-eng-26. $9.30(ph OTS); $3.60(mf OTS).

Progress is reported on the following: coulometric determination of Pu by titration with electrolytically generated U^{4+} and of chloride ion by titration with electrolytically generated Ag ions; spectrophotometric determination of Th in TBP–Amsco solutions; absorption spectrum of Np ions in aqueous solutions of UO_2SO_4 and in 1M H_2SO_4; gravimetric determination of S in purified molybdenite; volumetric determination of I_2 and IO_3^- and I^-, spectrophotometric determination of Fe, and indirect volumetric determination of Ni in homogeneous reactor fuel solutions; ion-exchange separation and polarographic determination of Re in Mo ores and in flue dusts; semimicrodetermination of fluorides in metal dissolver samples of the Thorex Process by pyrohydrolysis; a simplified model of an automatic titrator with Velocityservo control of the titrant addition; design of falling-drop densimeters for radioactive solutions; design of an automatic coulometric titrator; modifications to a shielded cubicle for chemical analysis of radioactive materials; γ spectrometric analysis for Pa^{233}, Zr–Nb, Ce, and Ru in Thorex solutions; design of a γ scintillation spectrometer for measuring Xe isotopes in the He stream of ANP; activities volatilized from reactor elements including the identification of a 0.77-Mev I^{132} γ ray; application of neutron-activation analysis and γ spectrometry to the determination of La and Am in Amex solutions, Eu in LiI, W in Fe, and As and Au in petroleum products; neutron-activation determination of Cl in graphitar bearings and Na, K, and Cs in Rb_2CO_3; separation of chloride and oxalate complexes on Dowex 1 resin beds; determination of particle-size distribution in thorium oxide–water slurries by neutron–activation–sedimentation analysis; nomograph for temperature calculations by the hydroxyl-band (R_2 branch) rotational-velocity method and temperatures of porous-cup discharges in $AgClO_4$ and $Cu(ClO_4)_2$ solutions; effect of undetected changes in contrast factor of photographic emulsions on accuracy of observed spectral line-intensity ratios when the background is present; d-c arc and a-c spark procedures for the determination of B in C and graphite; Hg-cathode electrodeposition of Cr, Fe, and Ni from solutions of stainless steel, Inconel, and similar alloys; preparation of K_2NiF_6; micropyrohydrolysis and spectrophotometric titration of fluorides; corrosion of stainless steel by uranyl sulfate reactor solutions containing chromate ions; half-life determinations of Be^7, Na^{24}, Sr^{85}, Nb^{95}, and Ru^{103}; polarographic determination of Ni and Co in homogeneous reactor solutions and of Ti; separation and spectrophotometric determination of Ti in Th by the ascorbic acid and chloroform–8-quinolinol methods; separation of Zr in thorium oxide slurries by ion exchange; ionic adsorption of various acids and of metal cations by thorium oxide; colorimetric determination of nickel uranyl sulfate solution; amperometric titration of mixed halides in uranyl sulfate solutions; and the analysis of monazite sand. (J.A.G.)

11587 WAPD-CTA-(GLA)-306
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
A COOPERATIVE STUDY ON THE DETERMINATION OF OXYGEN IN ZIRCONIUM. G. W. Goward. Jan. 8, 1957. 13p. $3.30(ph OTS); $2.40(mf OTS).

The methods most widely accepted for the determination of O_2 in Zr and Zircaloy are reviewed. The study was undertaken to compare all the common procedures to enable the selection of a standard method acceptable to both Zr procedures and users. (W.L.H.)

FLUORINE AND FLUORINE COMPOUNDS

11588 A-4035
Kellex Corp., New York.
THERMAL CONDUCTANCE OF C-716 [C_7F_{16}]–G-74 [N_2] MIXTURES. Joseph Greenspan, Kenneth Roach, Jacob Riseman, Joseph B. Farrell, and James A. Finneran. Sept. 11, 1944. Decl. Feb. 12, 1957. 59p. (D-20). $10.60(ph OTS); $3.90(mf OTS).

The thermal conductance of 0.00 to 100.00 mol/% C_7F_{16}–N_2 mixtures was measured. The apparatus used is described and data are presented graphically. (C.H.)

11589 ANL-4988(Del.)
Argonne National Lab., Lemont, Ill.
DETERMINATION OF ZIRCONIUM AND TOTAL FLUORIDE ION IN ZIRCONIUM–HYDROFLUORIC ACID SOLUTIONS. Seymour Vogler, Richard C. Vogel, and Roberta W. Shor. Feb. 16, 1953. Decl. with deletions Mar. 6, 1957. 22p. Contract W-31-109-eng-38. $3.30(ph OTS); $2.40 (mf OTS).

A method has been developed for determining Zr and F ion concentrations in HF solutions. This method is based upon the measurement of the density and electrical conductivity. From appropriate curves relating Zr and F ion concentrations with density and electrical conductivity, the concentrations of Zr and F ions may be determined. Uranium which is present to the extent of approximately 0.005M in dissolver solutions does not affect the electrical conductivity and produces a correction of approximately 0.6% in the Zr concentration. (auth)

GRAPHITE

11590 BNL-1895(Del.)
Brookhaven National Lab., Upton, N. Y.
STORED ENERGY IN BNL REACTOR GRAPHITE. J.

Chernick. Feb. 25, 1953. Decl. with deletions Feb. 12, 1957. 13p. Contract AT-30-2-gen-16. $3.30(ph OTS); $2.40(mf OTS).

Experiments were conducted to determine the stored energy in BNL-reactor-irradiated graphite. Results indicated a value of 40 ± 15 cal/gm. (C.H.)

11591 CC-2758

[Chicago. Univ. Metallurgical Lab.]
HEALING OF FAST-NEUTRON-INDUCED CHANGES IN GRAPHITE. III. FURTHER EXPERIMENTS ON EFFECT OF HEATING DURING EXPOSURE. T. J. Neubert, A. Novick, R. T. Schenck, E. Shapiro, and A. R. Van Dyken. Mar. 3, 1945. Decl. Feb. 16, 1957. 9p. Contract W-7401-eng-37. $1.80(ph OTS); $1.80(mf OTS).

It was established that heating samples of graphite during exposure in a pile decreases substantially the observed changes in the elastic modulus and electrical resistance caused by the irradiation. The functional relationship between the percentage changes observed and the temperature of exposure resembles the relationship between the final percentage changes and the temperature of heat treatment after exposure. Anomalous results reported previously for higher temperatures are shown to be attributable to a destructive influence on the graphite, probably oxidation of samples exposed in air. (auth)

11592 HW-43395

Hanford Atomic Products Operation, Richland, Wash.
THERMAL EXPANSION OF PILE GRAPHITES. W. C. Riley and E. M. Woodruff. May 25, 1956. Decl. Jan. 24, 1957. 29p. Contract W-31-109-Eng-52. $0.35(OTS).

Average coefficients of thermal expansion over the temperature range 25 to 425°C are reported for numerous types of graphite. The dependence of thermal expansion on crystal orientation and crystallite size and the effects of oxidation and cold test hole irradiation are discussed. An empirical relationship between thermal expansion and the initial rate of physical expansion under cold test hole irradiation is formulated. (auth)

SEPARATION PROCEDURES

11593 A-49(Del.)

Columbia Univ., New York. Div. of War Research.
COMPARISON OF DIFFERENT METHODS APPLICABLE TO THE SEPARATION OF THE URANIUM ISOTOPES. Harold C. Urey. [1942?]. Decl. with deletions Feb. 12, 1957. 22p. $4.80(ph OTS); $2.70(mf OTS).

The effectiveness of thermal diffusion, Hertz diffusion, Maier diffusion, distillation, and chemical exchange methods for the separation of uranium isotopes is discussed. (C.W.H.)

11594 A-2192

Columbia Univ., New York. Div. of War Research.
PROPERTIES OF SYNTHANE DIHYDRATES AND ITS RELATION TO WATER IN COMPLEX. Ellison H. Taylor. Sept. 1, 1945. Decl. Feb. 13, 1957. 24p. Contract W-7405-eng-50. (100B-R-324). $4.80(ph OTS); $2.70(mf OTS).

$BF_3 \cdot 2H_2O$ is one of the species likely to be present in wet dimethyl ether complex. Some of its properties are determined or confirmed in this research. These properties are discussed in their relation to the effect of water on the B isotope separation plant. The acidity measurements indicate that wet dimethyl ether complex should be highly corrosive. Nothing has been found that suggests that small amounts of water would have an effect upon the isotope separation. The vapor pressure data confirm previous estimates of the possibility of removal of water by distillation. Acceleration by water of the decomposition of dimethyl ether complex would be expected. The Karl Fischer reagent seems not to titrate hydroxyl groups in fluoboric acids. (auth)

11595 ACCO-65

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass.
THE DEVELOPMENT OF FIXED SCREEN RESIN-IN-PULP DEVICES. W. D. Charles, D. F. Thorpe, G. W. Lower, David Kaufman, N. N. Schiff, C. S. Abrams, H. I. Viklund, Fred Howland, and E. S. Porter. Aug. 5, 1954. Decl. Mar. 15, 1957. 41p. Contract AT(49-1)-533. $6.30(ph OTS); $3.00(mf OTS).

A resin-in-pulp process was developed using a series of fixed-screen or Winchester cells. Various laboratory and pilot plant models were constructed and tested under simulated plant conditions. The fixed-screen device proved very effective in the recovery of U and/or V by a continuous, resin-in-pulp process. (auth)

11596 ANL-RCV-SL-1094

Argonne National Lab., Lemont, Ill.
SEPARATION OF MOLYBDENUM HEXAFLUORIDE FROM URANIUM HEXAFLUORIDE—SIMPLE DISTILLATION OF URANIUM HEXAFLUORIDE—MOLYBDENUM HEXAFLUORIDE MIXTURES. Interim Report. L. Trevorrow. Aug. 29, 1956. Decl. Mar. 9, 1957. 6p. Contract [W-31-109-eng-38]. $1.80(ph OTS); $1.80(mf OTS).

11597 BMI-946

Battelle Memorial Inst., Columbus, Ohio.
RECOVERY OF THORIUM FROM BRAZILIAN MONAZITE SLUDGE BY NITRIC ACID DIGESTION. W. A. Meeley, M. J. Snyder, and R. B. Filbert, Jr. Aug. 24, 1954. Decl. Feb. 26, 1957. 28p. Contract W-7405-eng-92. $0.35 (OTS).

A method of treating Brazilian monazite sludge with nitric acid to solubilize up to 97% of the total thorium contained in the sludge was developed. Investigation of various digestion conditions showed that 96 to 97% of the total thorium was liberated in a solution containing about 125 g of thorium per liter by digesting a slurry, containing 0.7 g of anhydrous nitric acid per g of dry solids and 0.25 g of anhydrous nitric acid per g of water, for ½ hr with no external heat applied. These conditions appeared to be the optimum for high thorium extraction with minimum contamination and acid consumption. Oxidation of chloride ion to free chlorine with sodium chlorate showed promise as a method for removing the chloride, thereby reducing the corrosiveness of the digestion mixture. Caustic digestion of the sludge increased its filterability and permitted removal of both the chloride and the soluble phosphate by washing the solids. Corrosion tests showed Type 316 stainless steel to be the most resistance of the steels tested. (auth)

11598 BMI-JDS-135

Battelle Memorial Inst., Columbus, Ohio.
RECOVERY OF THORIUM AND URANIUM FROM MONAZITE SANDS. A. E. Bearse, E. G. Bohlmann, G. D. Calkins, and R. B. Filbert, Jr. Aug. 13, 1948. Decl. Feb. 21, 1957. 40p. Contract AT-30-1-Gen-228. $6.30(ph OTS); $3.00(mf OTS).

Experimental work on the recovery of Th and U from monazite sand has been carried out along two major lines. Initial work involved the conventional treatment with H_2SO_4 to solubilize the monazite, followed by fractional precipitation of the various constituents. The second line of attack involved treatment of the monazite sand with aqueous NaOH to permit removal of the phosphate, followed by dissolution in HNO_3 to give a solution suitable for recovery of Th and U by solvent extraction. (auth)

11599 CC-3146
Chicago. Univ. Metallurgical Lab.
SWEEPING OF FISSION GASES FROM SOLUTIONS OF URANIUM AND PLUTONIUM. Problem Assignment No. 263-MLC-3303. R. M. Adams and H. Finkelstein. Addendum: INTERPRETATION OF THE INFERENCES FROM THESE EXPERIMENTAL RESULTS. William Rubinson. Sept. 4, 1945. Decl. Mar. 13, 1957. 21p. Contract W-7401-eng-37. $4.80(ph OTS); $2.70(mf OTS).

Two experiments were performed to compare the amounts of fission gases swept out of UNH solutions with those amounts swept out of Pu solutions. The charged wire technique was used and the gas yield swept from U was found to be twice as large as the gas yield swept from Pu but the original fission yields differ very little. (F.S.)

11600 CF-50-2-112
Oak Ridge National Lab., Tenn.
CONFERENCE ON PLUTONIUM CHEMISTRY IN THE PUREX PROCESS AT ORNL. F. R. Bruce. Jan. 18, 1950. Decl. Mar. 13, 1957. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A review of the Purex Process is presented. The TTA Process is described, and other research programs on Pu chemistry at KAPL, ANL, and Hanford Works are reviewed. (T.R.H.)

11601 CF-50-4-2
[Oak Ridge National Lab., Tenn.]
ORNL 25 RECOVERY PROCESS DEVELOPMENT: MATERIAL BALANCE FOR ENRICHED URANIUM USED IN PROCESS VERIFICATION. A. M. Rom. Apr. 28, 1950. Decl. Apr. 1, 1957. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The material balance for the enriched U used in MTR 25 Process verification runs is shown with appropriate limits of error. (auth)

11602 CF-51-2-145(Del.)
Oak Ridge National Lab., Tenn.
SOLVENT EXTRACTION CHEMISTRY OF TBP. T. C. Runion. Feb. 28, 1951. Decl. with deletions Feb. 14, 1957. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A summary is given of data applicable to U–HNO_3–TBP systems for use in a uranium refinery. (L.T.W.)

11603 CF-51-3-78(Del.)
Oak Ridge National Lab., Tenn.
A SURVEY OF HOMOGENEOUS REACTOR CHEMICAL PROCESSING. F. R. Bruce. Mar. 19, 1951. Decl. with deletions Feb. 14, 1957. 38p. $6.30(ph OTS); $3.00(mf OTS).

A survey of chemical processing of homogeneous reactors for Pu production and U^{233} breeding is reported. The chemical processing, involving the fewest unknowns, for treating a homogeneous Pu producer would consist of the following steps: 20-day decay of Np to Pu, evaporation of UO_2SO_4 fuel to recover heavy water, conversion to a light water system, and finally, separation of U, Pu, and fission products by two tributyl phosphate extraction cycles. From a long range standpoint a more attractive process consists of coupling continuous Pu removal by ion exchange to U decontamination by tributyl phosphate extraction. The U^{233} breeder processing which seems most assured of success consists of evaporation of the ThO_2 blanket to dryness for heavy water recovery, dissolution of the ThO_2, and U^{233} recovery by methyl isobutyl ketone extraction. The major uncertainties involved in the processing of homogeneous reactors involve radiation stability, handling of heavy water and $N^{15}O_3^-$ ion, the chemical state of Pu formed in the reactor and solvent extraction behavior of short-cooled material, the chemistry of Np, and the chemistry of bentonite. (L.T.W.)

11604 CF-51-8-67(Del.)
[Oak Ridge National Lab., Tenn.]
COMPARISON OF PUREX PROCESS RESULTS IN MIXER SETTLERS AND PULSE COLUMNS. D. O. Darby. Aug. 13, 1951. Decl. with deletions Feb. 13, 1957. 15p. Contract [W-7405-ENG-26]. $3.30(ph OTS); $2.40(mf OTS).

11605 CF-51-8-85(Del.)
Oak Ridge National Lab., Tenn.
[PUREX PROCESS] SECOND URANIUM CYCLE (CT-51). Quarterly Report. J. R. Flanary. Aug. 10, 1951. Decl. with deletions. Feb. 13, 1957. 7p. Contract [W-7405-Eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Decontamination of U was reexamined as a function of HNO_3 concentration and percent U saturation of the solvent. Increasing the acid concentration increases the decontamination factors for Ru, but adversely affects the factors for Zr, Nb, and gross γ activity. The effect of percent U saturation of the solvent on decontamination was much more marked for Ru than for the other fission products. In 0.44M HNO_3 and in 1.7M HNO_3, the Ru distribution coefficients decreased by factors of 50 and 8 when the percent saturation is increased from 65 to 90. However, at 90% of saturation the coefficients for Ru were almost equal for both acid strengths. On the basis of these results, a new flowsheet was devised and resulted in a fourfold improvement in gamma decontamination. (auth)

11606 CF-51-11-65(Del.)
Oak Ridge National Lab., Tenn.
THOREX PROCESS DEVELOPMENT QUARTERLY REPORT FOR PERIOD AUGUST 10 TO NOVEMBER 10, 1951. A. T. Gresky. Nov. 12, 1951. Decl. with deletions Feb. 13, 1957. 24p. Contract [W-7405-Eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The extraction of U^{233} with dilute TBP and the extraction of Th with 30 to 50% TBP are reported. A brief study was made of the composition of the Th–TBP complex. The extraction of Pa^{233} in di-isopropyl carbinol and an investigation of two-phase organic systems are briefly described. A tentative flowsheet is offered for first-cycle extraction of Pa, U^{233}, and Th. (L.T.W.)

11607 CF-51-11-161
Oak Ridge National Lab., Tenn.
ORNL RaLa AND MTR RaLa PROCESS DEVELOPMENT. Quarterly Report for Period August 10–November 10, 1951. Chemical Technology Div. R. E. Blanco. Nov. 5, 1951. Decl. Apr. 2, 1957. 25p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The ORNL RaLa ion exchange purification process was revised to permit the production of the larger batches now required. The changes, listed as follows, were designed to minimize the radiation damage to the system and decrease the sensitivity of the feed solution to radiation damage: substitute $NaC_2H_3O_2$ for Versene as the first feed solution, and increase the flow rates and column size. A full chemical scale tracer level demonstration run showed that the Ba yield will be 96% and that the product will meet purity specifications. In the MTR RaLa Process, the solubility of U in the caustic dissolver solution and the volume of H evolved during the dissolution were studied as a function of Al, $NaNO_3$, NaOH, Na_2CO_3 and $Ca(NO_3)_2$ concentrations. Using the recommended conditions of 5.0M Al, 2.5M $NaNO_3$ and 5.0M NaOH, the U solubility was approximately 7 mg/liter ≈ 15% U loss, and the volume of H evolved was 9 liters/MTR-assembly. (auth)

11608 CF-52-2-131 (Del.)
Oak Ridge National Lab., Tenn.
CONTINUOUS DISSOLVING–QUARTERLY REPORT FOR PERIOD NOVEMBER 10, 1951 TO JANUARY 10, 1952. D. L. Foster and E. O. Nurmi. Feb. 11, 1952. Decl. with

deletions Feb. 14, 1957. 10p. Contract [W-7405-Eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A small-scale continuous dissolver was built and tested to determine the feasibility of its operation. The dissolver consisted of a one-stage or two-stage vertical column packed with the metal to be dissolved. Dissolving solution passes down the column reacting as it goes. This dissolver has given very favorable results in dissolving U, Th, and Al–U alloy metals. (L.T.W.)

11609 CF-53-1-324(Del.)
Oak Ridge National Lab., Tenn.
FUEL PROCESSING OF A HOMOGENEOUS THERMAL BREEDER. D. E. Ferguson. Jan. 30, 1953. Decl. with deletions Feb. 14, 1957. 16p. Contract [W-7405-Eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The requirements of processing the fuel solution of a two-core aqueous homogeneous reactor used as a thermal breeder are outlined. The intermediate scale homogeneous reactor is used as the basis of the discussion. Three general methods of removing nongaseous fission products from the fuel solution were evaluated: complete decontamination of the fuel by solvent extraction, adsorption of cationic fission products by an organic ion exchange medium, and adsorption of cationic fission products with an inorganic adsorbent. (L.T.W.)

11610 CF-53-3-102
Oak Ridge National Lab., Tenn.
USE OF "HOT" SOLVENT IN THE PUREX SECOND URANIUM CYCLE. R. W. Vest. Mar. 11, 1953. Decl. Feb. 16, 1957. 16p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

Laboratory investigation of the possibility of using first-cycle solvent in the second U cycle has yielded results which indicate that the present dual-solvent recovery system is necessary if product activity specifications are to be met, unless a new solvent recovery system which will more effectively remove the fission products from the organic waste streams is developed. (auth)

11611 CF-53-7-45(Rev.)
Oak Ridge National Lab., Tenn.
CALCULATIONS OF DECONTAMINATION OF MTR MATERIALS BY THE 25 PROCESS. F. R. Bruce. July 8, 1953. Decl. Mar. 7, 1957. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The major activities associated with ICPP product from MTR assemblies are calculated as a function of cooling time. (T.R.H.)

11612 CF-54-6-178
Oak Ridge National Lab., Tenn.
URANIUM RECOVERY FROM BOMB LINER AND SCRAP BY ION EXCHANGE. I. R. Higgins. June 8 1954. Decl. Apr. 2, 1957. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Three ion exchange processes were studied for the recovery of uranium from acid C–oxide scrap leach liquors. The recovered U product met or was lower than specifications of 0.05% chloride and fluoride content in each case. (auth)

11613 CF-54-11-148 (Del.)
Oak Ridge National Lab., Tenn.
25 PROCESS ASSISTANCE. FOR PERIOD OF OCTOBER 29–NOVEMBER 12, 1954. Floyd L. Culler. Nov. 23, 1954. Decl. with deletions Feb. 14, 1957. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Caustic-nitrate laboratory studies, clarification of caustic dissolver solution, first-cycle U extraction, and stripping of U from TBP using aqueous citrate solutions are briefly discussed. (C.H.)

11614 CF-55-9-12
Oak Ridge National Lab., Tenn.
DESIGN OF CHARCOAL ADSORBERS FOR THE HRT. T. W. Leland. Sept. 6, 1955. Decl. Feb. 15, 1957. 38p. Contract [W-7405-eng-26]. $0.40(OTS).

The design specifications for the HRT fission product adsorption system are outlined. The calculations upon which the design is based are summarized, and a sample calculation is presented. The calculations solve approximate equations for the depletion of isotopes from the gas stream produced by isothermal increments of the adsorption bed after steady state conditions have been attained and for the radial temperature distribution in the bed at steady state conditions. (M.P.G.)

11615 CF-56-3-22
Oak Ridge National Lab., Tenn.
OPERATING PROCEDURE FOR THE HRT CHEMICAL PLANT. R. B. Lindauer. Mar. 5, 1956. Decl. Mar. 14, 1957. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A detailed procedure for operating the core processing plant for the HRT is described. The schematic flow diagram of the plant is included to aid in following the operations. (W.L.H.)

11616 CF-56-4-101(Suppl. 1)
Oak Ridge National Lab., Tenn.
HRP-CP: ANALYTICAL REQUIREMENTS FOR THE HRT CHEMICAL PROCESSING PLANT. William L. Carter. June 7, 1956. Decl. Mar. 16, 1957. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A previous memorandum, ORNL CF-56-4-101, on this subject detailed an analytical schedule for the HRT core processing plant. Several additional analyses that will be required are pointed out, and suggestions are made which will work toward minimizing the possibility of contaminating the reactor. (L.T.W.)

11617 CF-56-4-184
Oak Ridge National Lab., Tenn.
THOREX PILOT PLANT: DECONTAMINATION RUN IX-16. J. H. Walker and G. S. Sadowski. Apr. 18, 1956. Decl. Mar. 14, 1957. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The feed adjustment tank was decontaminated to a final radiation level of 950 mr/hr at contact with 30% HNO_3 and 20% NaOH–2% sodium tartrate solution. The top of the partitioning column was easily decontaminated to 13 mr/hr, but decontamination of the BT evaporator was limited by contaminants on the walls of the cubicle. The radiation level at the evaporator was only decreased from ~ 600 to 400 mr/hr. Two acid treatments alternated with two caustic–tartrate treatments were sufficiently effective to reduce the radiation level at the bottoms of the stripping column from 2,300 to 230 mr/hr. An elution of the silica gel column with 0.5 M HNO_3 followed by 4% oxalic acid brought the radiation level of the column from 23,000 to 4000 mr/hr. Exposure rates and levels for maintenance personnel are given. (L.T.W.)

11618 CF-56-8-101(Del.)
Oak Ridge National Lab., Tenn.
POWER REACTOR FUEL PROCESSING STATUS REPORT FOR AUGUST 1956. R. E. Blanco, W. K. Eister, and D. E. Ferguson. Aug. 15, 1956. Decl. with deletions Mar. 20, 1957. 20p. $3.30(ph OTS); $2.40(mf OTS).

Hermex Process. Fernald scrap uranium was significantly decontaminated by Hermex processing. Zircex Process. Removal of zircaloy-2 jackets from UO_2 cores by hydrochlorination did not form UO_2Cl_2 or affect the solubility of the cores seriously. A hydrochlorinator for

dissolution of 3-in. lengths of zirconium-uranium (STR type) fuel elements was designed and installed for use in larger-scale studies of the Zircex process. Darex Process. Hydrogen was not found in the off-gas from dissolution of stainless steel in aqua regia. A dissolver was designed for larger-scale studies, and a flowsheet using this dissolver was drawn up. Corrosion tests indicated tantalum to be the best material tested for dissolver construction. Vapor-liquid equilibrium data for the $HCl-HNO_3-H_2O$ system were correlated for use in designing a distillation system for removing HCl from dissolver solution. (auth)

11619 CN-508

[Chicago. Univ. Metallurgical Lab.]
DECONTAMINATION OF PRODUCT BY ADSORPTION ON TAILOR-MADE INORGANIC ADSORBENTS. E. R. Russell, A. W. Adamson, J. Schubert, and G. E. Boyd. Mar. 6, 1943. Decl. Mar. 21, 1957. 23p. (A-653). $4.80(ph OTS); $2.70(mf OTS).

The surface properties of various substances known to carry Pu were studied in order to find a method of separating Pu from a large number of adsorbed fission products. Of these substances, zirconium phosphate seemed to offer promise as a specific adsorbent for Pu. A number of exploratory experiments were performed, and the results are summarized. (B.J.H.)

11620 CN-728

Chicago. Univ. Metallurgical Lab.
CHEMICAL RESEARCH—PRODUCTION AND EXTRACTION OF PLUTONIUM REPORT FOR MONTH ENDING JUNE 21, 1943. Decl. Apr. 2, 1957. 79p. Contract [W-7401-eng-37]. (A-913). $13.80(ph OTS); $4.80(mf OTS).

11621 HW-12183

Hanford Works, Richland, Wash.
POLAROGRAPHIC ANALYSIS OF UNH IN THE IAW STREAM. G. J. Alkire and W. N. Carson, Jr. Jan. 17, 1949. Decl. Apr. 1, 1957. 16p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The polarographic determination of UNH has been applied to the IAW stream, for concentrations ranging from 0.2 to 100 g/l. The reduction of UO_2^{2+} in the supporting electrolyte used does not follow the Ilkovic equation over the entire range of concentration investigated. Statistical analysis of the data has shown that the diffusion current (I_d) and concentration (C) are related in a quadratic equation with empirical constants: $C = a + b\,I_d + d\,I_d^2$. The method is rapid and accurate to within 5% in the range 1.0 to 100 g/l and 12% below 1.0 g/l. (auth)

11622 HW-21442

Hanford Works, Richland, Wash.
COATING REMOVAL WASTE LOSS REDUCTION. Final Report. Production Test 221-B-8. B. E. Kirkendall. June 25, 1951. Decl. Mar. 4, 1957. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

It was demonstrated that the Pu and U losses associated with the Al jacket dissolution could be reduced by substituting a water wash for the 5% HNO_3 wash following the coating removal and that this change would not adversely affect the product yield or decontamination in subsequent process steps. (D.E.B.)

11623 HW-45620

Hanford Atomic Products Operation, Richland, Wash.
RUTHENIUM BEHAVIOR IN NITRIC ACID DISTILLATION. A. S. Wilson. Sept. 1, 1956. Decl. Mar. 16, 1957. 18p. Contract W-31-109-Eng-52. $0.30(OTS).

The volatilization of Ru increases with increasing HNO_3 concentration and reaches a plateau at acid concentrations of about 8 to 10M. Only about 1 to 2% of the Ru, at the most, is volatilized. Mild reducing agents such as HNO_2, NO_2, and a 30% TBP-Soltrol 170 mixture, suppress the volatilization of Ru from HNO_3. In the absence of air Ru distills from HNO_3 as RuO_4. In the presence of air an unidentified Ru species appears in the distillate. (auth)

11624 IDO-14226

American Cyanamid Co. Atomic Energy Div., Idaho Falls, Idaho.
SETTLING RATES OF PARTICLES IN DISSOLVER SOLUTION 3002 UM-1Fu. G. K. Cederberg. Feb. 24, 1953. Decl. Mar. 13, 1957. 9p. Contract AT-(10-1)-177. $1.80(ph OTS); $1.80(mf OTS).

The settling rates at room temperature of the smallest and largest particles in the difficult filtering MTR dissolver solution 3002UM−1Fu were found to be 0.66 and 80.0 cm/hr, respectively. The particle sizes of the residue, which were estimated from photomicrographs of the particles, compared favorably with those calculated by Stoke's law from these experimental settling rates. (auth)

11625 ISC-407

Ames Lab., Ames, Iowa.
A PROCESS FOR SEPARATING THORIUM COMPOUNDS FROM MONAZITE SANDS. Kernal Glenn Shaw, Morton Smutz, and G. L. Bridger. Jan. 1954. Decl. Feb. 26, 1957. 109p. Contract W-7405-eng-82. $0.65(OTS).

Studies were made in the laboratory and in a pilot plant to determine the optimum conditions for the digestion of monazite sand and for the separation of thorium, rare earths, and uranium by fractional neutralization of the monazite sulfate solution. The most effective separation was obtained when the monazite solution was diluted and when ammonium hydroxide was used as a neutralizing agent. The process is described. The over-all recovery of thorium was 96 to 97%, of rare earths 98 to 99%, and of uranium 53 to 54%. The remainder of the thorium and uranium can be recovered by further processing. A cost comparison was made between the Ames Laboratory process and a process developed by the Battelle Memorial Institute for a plant which would produce five tons of thorium per month from Idaho monazite sand. The estimated processing cost for the Ames Laboratory process was $9.11 per pound of thorium as compared with $11.48 per pound for the Battelle process. Both of these costs included $4.67 for the cost of the monazite sand. The Battelle caustic digestion process produced two hydroxide concentrates. One contained thorium and uranium. The other contained rare earths. Hydroxide concentrates could also be produced by the Ames Laboratory process by a caustic digestion of the three phosphate concentrates at an additional cost of about $1.25. (auth)

11626 ISC-415

Ames Lab., Ames, Iowa.
PURIFICATION OF THORIUM BY SOLVENT EXTRACTION. M. E. Whatley, Morton Smutz, and G. L. Bridger. July 1953. Decl. Feb. 26, 1957. 92p. Contract W-7405-eng-82. $0.60(OTS).

Investigations were made of the solvent extraction of thorium nitrate with tributyl phosphate from aqueous solutions containing phosphate, sulfate, and nitric acid. It was the specific objective to develop a process to produce pure thorium from a thorium concentrate obtained by the selective precipitation of thorium phosphate from a monazite-sulfuric acid solution. A study of the effect of a diluent in the solvent mixture led to the choice of 80% TBP−20% inert diluent. The effects of phosphate, sulfate, and nitric acid on the thorium distribution coefficient were studied in detail. The thorium distribution coefficient was greatly decreased by the presence of phosphate, decreased to a lesser extent by the presence of sulfate, and greatly increased by the presence of

large amounts of nitric acid. It was found that, by the use of high concentrations of nitric acid, the detrimental effect of phosphate and sulfate could be overcome and thorium extracted from solutions containing up to 20 g/l phosphate (P_2O_5) and/or sulfate. Because the use of 80% TBP afforded only a small difference in density between the solvent and aqueous phases, it was necessary to develop a mixer-settler with exceptionally good interface level control. The principle of operation and the design of both a laboratory glass unit and a box-type unit adaptable to industrial use are discussed. A pilot plant extractor was assembled and a continuous countercurrent extraction run was made. The capacity of the unit was 0.39 lb of thorium per hr. The feed, containing about equal parts thorium and rare earths, was prepared from a thorium phosphate concentrate from the Ames monazite process. There were seven stages in the extraction section, nine stages in the scrub section, and five stages in the strip section. The recovery of thorium was 92% and the product thorium contained less than four parts per million total rare earths. The selection of operating conditions for the run and the interpretation of the data are discussed. (auth)

11627 KAPL-223(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
BEHAVIOR OF CERIUM IN WATER–HEXONE SYSTEMS. Edgar C. Pitzer. Sept. 15, 1949. Decl. Mar. 25, 1957. 43p. Contract W-31-109-eng-52. $7.80(ph OTS); $3.30 (mf OTS).

11628 KAPL-M-DJS-1
Knolls Atomic Power Lab., Schenectady, N. Y.
A CONTINUOUS ION EXCHANGE SYSTEM FOR URANIUM CONCENTRATION AND DECONTAMINATION IN THE THOREX PROCESS. Donald J. Smith. Apr. 1, 1955. Decl. Mar. 15, 1957. 17p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The design for a continuous ion exchange system for use in the concentration and decontamination of the U stream following the solvent extraction cycles in the Thorex Process is given. The moving bed technique is compared to a fixed bed system under similar conditions. (W.L.H.)

11629 KLX-1217
Kellex Corp., New York.
PROGRESS REPORT [FOR] MAY 1951. Job 23. June 27, 1951. Decl. Mar. 28, 1957. 70p. Contract AT(30-1)848. $10.80(ph OTS); $3.90(mf OTS).

Summation is made of results of studies of the recovery of U from MCW acid raffinate, and from MCW C-3 discard liquor, and the practicability of removing by ion exchange, U from MCW sewer streams and from proposed "new refinery" sewer streams. An investigation has been made of the solubilization of U from Tonawanda and St. Louis wastes and its adsorption from leach liquor by ion exchange. Results are discussed of an investigation of the digestion conditions necessary for the recovery of the U in C-Special and C-Liner by treatment with HCl, the precipitation of ammonium uranate by treatment of the HCl digest liquor with ammonium hydroxide, the dissolution of the resultant ammonium salt by treatment with HNO_3, the extraction of the uranyl nitrate solution formed with TBP-kerosene, and the removal of the residual fluoride ion by scrubbing the organic extract with Al and ferric nitrate solutions. A summary is made of work to date to determine conditions for ore digestion which would produce a residue having a minimum U_3O_8 content, and to determine by means of a 5-stage batch countercurrent extraction the efficiency of U extraction from pitchblende–HNO_3 slurry, the purity and Ra content of the final U obtained, and the general characteristics of slurry extraction, the operability and efficiency of typical extraction when the aqueous feed is a slurry, and the time required for phase separation in a mixer-settler type system and how these times varied with the type of agitator used, the agitator speed, and U concentration in the organic and aqueous phases. (F.S.)

11630 KLX-1329
Kellex Corp., New York.
DECONTAMINATION OF CRIB WASTES(24-A3). Progress Report for Fourth Quarter 1950 Covering Period October 1–December 31, 1950 on Job 24-A. Jan. 18, 1951. Decl. Mar. 4, 1957. 28p. Contract AT(30-1)-850. $4.80 (ph OTS); $2.70(mf OTS).

The principal effort during the present report period was applied to the decontamination of simulated low-activity wastes prepared by the dilution of Purex waste with particular emphasis on the effect of added salts, feed pH, and feed activity on the volume of waste decontaminated by a given volume of resin. Tests have been conducted in which a simulated acid eluate has been used for the preparation of concrete. Various mechanical methods of mixing the eluate and the dry cement are being evaluated for testing in the pilot plant. Preliminary results of tests on a saturated lead sulfamate solution as a fluid shield material are inconclusive. In a study of the physical performance of resin beds, measurements of pressure drop versus flow rate were made under varying conditions. Pilot plant design initiated in September has been completed, equipment specifications have been prepared, and all material has been ordered. A process flow diagram of the pilot plant is included in this report. (C.H.)

11631 KLX-1372
Vitro Corp. of America, New York.
PROJECT SUMMARY. DECONTAMINATION OF DILUTE LOW ACTIVITY WASTES (24-A3). Job 24-A. July 5, 1952. Decl. Mar. 12, 1957. 74p. Contract AT(30-1)-850. $12.30(ph OTS); $4.50(mf OTS).

This investigation lead to the successful design and operation of an ion exchange resin pilot plant in which 50,000 gal of simulated still over heads, containing 500 c/m/ml (~ 10 ppm total solids) of Purex waste, were processed per ft^3 of resin at 40 gal/hr with a final effluent activity of $\sim 10^{-6}$ μc/ml. Provision was made for the disposal of the loaded resin as a monolith or for elution and disposal of the eluate as a monolith with re-use of the adsorbent. (auth)

11632 KLX-1601
Vitro Corp. of America, New York.
HOMOGENEOUS REACTOR PROCESSING PROGRESS REPORT [FOR] MAY 1952. Job 57. June 16, 1952. Decl. Mar. 25, 1957. 37p. Contract AT(11-1)-217. $6.30(ph OTS); $3.00(mf OTS).

A method for recovering D_2O solvent from spent homogeneous reactor UO_2SO_4 fuel solution is developed. A study is made for determining the feasibility of ion exchange separation of fission products from UO_2SO_4 solutions for comparison with alternate decontamination processes. A large scale preparation of a satisfactory homogeneous reactor fuel by conversion of pure UF_6 to UO_2SO_4 dissolved in D_2O is studied. (J.E.D.)

11633 KLX-1602
Vitro Corp. of America, New York.
HOMOGENEOUS REACTOR PROCESSING PROGRESS REPORT [FOR] JUNE 1952. JOB 57. JULY 7, 1952. Decl. Mar. 28, 1957. 50p. Contract AT(11-1)-217. $7.80 (ph OTS); $3.30(mf OTS).

A method is developed for recovery D_2O solvent from spent homogeneous reactor UO_2SO_4 fuel solution. A study is made for determining the feasibility of ion exchange

separation of fission products from UO_2SO_4 solutions for comparision with alternate decontamination processes. A large scale preparation of a satisfactory homogeneous reactor fuel by conversion of pure UF_6 to UO_2SO_4 dissolved in D_2O is studied. (W.L.H.)

11634 KLX-1608
Vitro Corp. of America, New York.
HOMOGENEOUS REACTOR PROCESSING PROGRESS REPORT [FOR] DECEMBER 1952. Job 57. Jan. 10, 1953. Decl. Mar. 22, 1957. 36p. Contract AT(11-1)-217. $6.30(ph OTS); $3.00(mf OTS).

The development of the most economical method for recovering D_2O solvent from spent homogeneous reactor UO_2SO_4 fuel solution and the principal basic requirements for such a method are reported. The decontamination of spent fuel solutions by use of ion exchange resins and nonresinous solid adsorbents to remove neutron absorbing fission products and the recovery of U from adsorbents are presented. An economical process for large-scale preparation of a satisfactory homogeneous reactor fuel by conversion of pure UF_6 to UO_2SO_4 dissolved in D_2O is developed. (J.E.D.)

11635 KLX-1711
Vitro Corp. of America, New York.
HOMOGENEOUS REACTOR FUEL REPROCESSING. JOB 87. Quarterly Progress Report For October 1—December 31, 1953. Jan. 18, 1954. For Oak Ridge National Lab. Decl. Mar. 9, 1957. 28p. Contract W-7405-eng-26, Subcontract No. 535. $0.35(OTS).

The development of a simple process for removing rare earth fission product ions from short-cooled UO_2SO_4 solutions is reported. A study of the operating variables of an adsorber utilizing CaF_2 and the evaluation of several methods for removing dissolved Ca and fluoride ions from the adsorber effluent were made. An investigation of adsorbents other than CaF_2 was made. (J.E.D.)

11636 KLX-10012
Vitro Labs., West Orange, N. J.
HOMOGENEOUS REACTOR FUEL REPROCESSING QUARTERLY PROGRESS REPORT [FOR] JULY 1—SEPTEMBER 30, 1955. Job 1087. Harold F. Reichard, John D. McAdoo, Stanley J. Klach, Gloria K. Koenig, and Paul E. Smith. Nov. 15, 1955. Decl. Mar. 25, 1957. 21p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 535. $0.35(OTS).

The equilibrium distribution of I_2 was studied between vapor and liquid phases in a simulated homogeneous reactor fuel solution. Calculations were made to determine the feasibility of using countercurrent inert gas stripping of fuel solution in packed columns. (For preceding period see KLX-10006.) (auth)

11637 KLX-10020
Vitro Labs., West Orange, N. J.
HOMOGENEOUS REACTOR FUEL REPROCESSING. Quarterly Progress Report [for] October 1—December 31, 1955. Dept. of Chemical Research and Development. Harold F. Reichard, John D. McAdoo, Stanley J. Klach, Gloria K. Koenig, and Paul E. Smith. Jan. 31, 1956. Decl. Apr. 2, 1957. 27p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 535. $0.35 (OTS).

A gas stripping process for short-term I_2 removal is being studied as a means of Xe^{135} poison control in an aqueous homogeneous reactor. A liquid jet ejector is being developed to serve the purpose of a single-stage contactor for pumped fuel solution and stripping gas and a high-capacity low-head compressor for circulating the strip gas through an iodine absorption cycle. Laboratory studies were continued on batch scrubbing of iodine and acid dissolution of ThO_2. (For preceding period see KLX-10012.) (C.W.H.)

11638 KLX-10034
Vitro Labs., West Orange, N. J.
HOMOGENEOUS REACTOR FUEL REPROCESSING. Quarterly Progress Report [for] April 1—June 30, 1956. Vitro Job 1087. Harold F. Reichard, John D. McAdoo, Stanley J. Klach, Gloria K. Koenig, and Paul E. Smith. July 31, 1956. Decl. Mar. 29, 1957. 14p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 535. $0.30(OTS).

The behavior of volatile fission products in aqueous homogeneous reactor core solution was studied. Particular attention is given to the chemistry of I_2, with the specific objective of removing I_2 rapidly from the fuel as a means of controlling Xe^{135} poisoning. Feasibility of high-pressure oxygen stripping of I_2 with an ejector is being studied as a means of implementing this process. (auth)

11639 KT-71
Massachusetts Inst. of Tech., Oak Ridge Tenn. Engineering Practice School.
FILTRATION OF THIOCYANIC ACID CONDENSATION PRODUCTS IN THE ZIRCONIUM—HAFNIUM SEPARATION PLANT. G. R. Jansy and H. T. Tupper. June 20, 1950. Decl. Mar. 4, 1957. 10p. For Carbide and Carbon Chemicals Div. [K-25 Plant. Contract W-7405-eng-26, Subcontract 70]. $1.80(ph OTS); $1.80(mf OTS).

The plate-and-frame filter press appears to be a satisfactory means of reducing solids in the extraction and scrubbing towers used in zirconium production. The press operated continuously for as long as 39 hours, with a minimum over-all filtration efficiency of 50%. Celite (diatomaceous earth) seems superior to charcoal as a filter aid in this operation. It offers longer filtration periods and better filtration efficiency. The use of a single pre-coat of Celite may be as adequate as a precoat followed by regular addition of smaller amounts of filter aid. Occasional shutdown of the press seems to improve rate of filtration, possibly because solid particles tend to grow in size during the shutdown. (auth)

11640 KT-79
Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.
APPLICATION OF PULSE COLUMN TO RECOVERY OF URANIUM IN WASTE SOLUTIONS. R. P. Webb, W. L. Griffith, M. E. Nathan, and J. F. O'Donnell. June 28, 1950. Decl. Mar. 4, 1957. 13p. For Carbide and Carbon Chemicals Div. [K-25 Plant]. Contract [W-7405-eng-26, Subcontract 70]. $3.30(ph OTS); $2.40(mf OTS).

11641 KT-84
Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.
PULSE-COLUMN OPERATING CONDITIONS FOR URANIUM RECOVERY FROM WASTE SOLUTIONS. H. A. Larsen, D. L. James, G. T. Parish, and J. D. Roarty. Sept. 13, 1950. Decl. Mar. 8, 1957. 19p. For Carbide and Carbon Chemicals Div. [K-25 Plant]. Contract [W-7405-eng-26, Subcontract 70]. $4.80(ph OTS); $2.70(mf OTS).

11642 KT-148
Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.
SEPARATION OF ZIRCONIUM—HAFNIUM USING SOLUTIONS CONTAINING TRIBUTYLAMINE. R. G. Shaver, J. V. Gaven, A. C. Herrington, and C. E. Thies. Oct. 18, 1952. Decl. Mar. 4, 1957. 33p. For Carbide and Carbon

Chemical Div. [K-25 Plant]. Contract [W-7405-eng-26, Subcontract 70]. $6.30(ph OTS); $3.00(mf OTS).

The separation of Hf from Zr in commercially available $ZrCl_4$ is carried out by a solvent extraction process in a spray column system. Ammonium thiocyanate is added to the aqueous feed solution of $ZrCl_4$, and the organic phase of methylisobutyl ketone is passed countercurrently, the Hf being preferentially absorbed by the ketone. The separation coefficient is nearly constant for large ranges of Zr concentration and is approximately 5. (auth)

11643 LRL-73(Rev.)
California Research and Development Co. Livermore Research Lab., Livermore, Calif.
THE DISSOLUTION OF ZIRCONIUM-CLAD URANIUM TARGET ELEMENTS. R. H. J. Gercke and W. H. McVey. Dec. 1953. Decl. Feb. 28, 1957. 17p. Contract AT(11-1)-74. $0.30(OTS).

Zirconium-clad uranium elements can be successfully dissolved in nitric acid and fluoride (from HF or HBF_4) to form feed solutions amenable to Purex processing. A generalized discussion is included covering the mechanism of dissolution involved. Data are presented covering dissolution of uranium and zirconium under varied conditions, dissolution stability, component distribution between feed and extractant, effects of various agents upon Pu^{+4} extraction and zirconium precipitates, and off-gas composition. (W.L.H.)

11644 M-3028
[Du Pont de Nemours (E. I.) & Co.] Jackson Lab., Wilmington, Del.
TENTATIVE DYE WORKS PROCESS FOR THE MANUFACTURE OF C-100 FROM N. G. SOLUTIONS. C. W. Maynard, Jr. May 21, 1943. Decl. Mar. 7, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

N. G. solutions made from C-102(U_3O_8) or C-112($UO_4 \cdot 2H_2O$) are clarified, concentrated, and re-extracted with ether until extraction becomes difficult or uneconomical. They are then causticized to pH 2.5 to precipitate Fe and other impurities, filtered, and low-sodium C-100($Na_2O \cdot 2UO_3$) is precipitated from the filtrate with caustic, isolated by filtration, and washed chloride free. N. G. solutions made from $Na_2O \cdot 2UO_3$ are essentially freed from sulfate ion with $BaCO_3$ if necessary, causticized to pH 2.5, and handled as above. (L.T.W.)

11645 MCW-21(Rev.)
Mallinckrodt Chemical Works, St. Louis.
SOME FACTORS INFLUENCING THE DISTRIBUTION OF MOLYBDENUM COMPLEXES AND BORIC ACID IN ETHER–WATER–URANYL–NITRATE SYSTEMS. R. P. Smith. Apr. 1, 1946. Decl. Feb. 28, 1957. 23p. Contract W-14-108-Eng-8. $4.80(ph OTS); $2.70(mf OTS).

Experimental studies on the effects of excess HNO_3, feed pH, Fe in the feed, salting agents, and reducing agents on the distribution of phosphomolybdic and silicomolybdic acids in ether extractions of $UO_2(NO_3)_2$ and the effects of feed pH, feed Fe, and salting agents on the distribution of boric acid are reported in detail. Optimum conditions for keeping these acids at a minimum are low excess HNO_3 (high pH of feed), high concentration of Fe in feed, and no salting agents other than $Fe(NO_3)_3$. (W.L.H.)

11646 MLM-475
Mound Lab., Miamisburg, Ohio.
GENERAL RESEARCH REPORT FOR APRIL 1–JUNE 26, 1950. (Radium Volume). July 31, 1950. Decl. Feb. 26, 1957. 104p. Contract AT-33-1-GEN-53. $0.60(OTS).

Research was continued on the development of a process for the separation and purification of Ra from pitchblende residues. (For preceding period see MLM-443-2.) (C.W.H.)

11647 ORNL-1384
Oak Ridge National Lab., Tenn.
MATERIALS CHEMISTRY DIVISION, URANIUM CHEMISTRY OF RAW MATERIALS SECTION PROGRESS REPORT FOR APRIL 1, 1952 TO JUNE 30, 1952. Decl. Mar. 7, 1957. 156p. Contract W-7405-eng-26. $24.30(ph OTS); $7.50(mf OTS).

Process development work was devoted primarily to U recovery from lignite and from Florida Leached Zone material. A small amount of additional time was devoted to studies on the pressure leaching of Marysvale ores, and the precipitation of U and V from Na carbonate solutions with Na hydrosulfite. The U chemistry program included investigation of the solvent extraction of U from aqueous nitrate, sulfate, phosphate, and fluoride solutions through use of organic complexing agents, especially organophosphorus compounds; the extraction of Th from H_2SO_4 solutions of monazite sand with organophosphorus acids; the extraction of U from sulfate and phosphate solutions with secondary amines, tertiary amines, and quaternary ammonium salts; studies of the behavior of hexavalent U in phosphate solutions; and the reduction of U in Na carbonate solutions. (W.L.H.)

11648 ORNL-1812
Oak Ridge National Lab., Tenn.
THE ELECTROCHEMICAL UTILIZATION OF ION EXCHANGE MEMBRANES IN AEC OPERATIONS. E. J. Parsi. Jan. 27, 1955. Decl. Feb. 23, 1957. 34p. Contract W-7405-eng-26. $0.35(OTS).

The feasibility of concentrating acids and bases, of preparing acid-deficient salt solutions, and of preparing acids and bases by the electrochemical utilization of ion-exchange membranes was demonstrated. The concentration of hydrofluoric acid by electrodialysis techniques was shown to be a simple, compact, and inexpensive operation. Monobasic aluminum nitrate was prepared economically and continuously in an electrolytic cell which used ion-exchange membranes. Purified alkali hydroxide was obtained from its sulfate salt in a similar electrodialysis-membrane cell. Separation of alkali metals in an ionic fractionation still was shown to be possible, but separation factors were small. Separation of hydrogen and deuterium by electromigration through a palladium diaphragm was investigated briefly. (auth)

11649 WAPD-PWR-CP-2673
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
REMOVAL OF RADIOIODINE FROM PWR PLANT CONTAINER AIR. A. S. Kesten. Jan. 28, 1957. 4p. Addendum to WAPD-PWR-CP-2428. $1.80(ph OTS); $1.80(mf OTS).

Removal of radioiodine from air streams by the CWS-type filters appears to be satisfactory for all three sets of water conditions tested: neutral with H_2, basic with H_2, and acid with O_2. Retention in the filter was checked only for the neutral, and hydrogenated set of conditions. (W.L.H.)

SYNTHESES

11650 K-220(II(Del.))
Carbide and Carbon Chemicals Corp. K-25[Plant], Oak Ridge, Tenn.
FLUOROCARBONS AND FLUOROORGANIC COMPOUNDS. SECTION II. J. L. Gabbard, J. D. Gibson, A. V. Faloon, K. E. Rapp, S. E. Frey, and D. V. Walker. Aug. 2, 1948. Decl. with deletions Feb. 25, 1957. 413p. Contract [W-7405-eng-26]. $66.60(ph OTS); $11.10(mf OTS).

Information is presented on the preparation and chemical properties of fluorocarbons and fluoroörganic compounds prepared for research purposes. (C.H.)

URANIUM AND URANIUM COMPOUNDS

11651 BMI-932
Battelle Memorial Inst., Columbus, Ohio.
LARGE-BATCH MELTING OF URANIUM. R. M. Lang, G. W. Rengstorff, N. H. Keyser, and H. W. Lownie, Jr. Aug. 2, 1954. Decl. Feb. 23, 1957. 34p. Contract W-7405-eng-92. $0.35(OTS).

A preliminary investigation of the feasibility of melting U in open electric furnaces for FMPL has been completed. Both a 3-phase direct-arc furnace and a high-frequency induction furnace were used. In the direct-arc furnace, only 15% of the metal charged was recovered as metal. In the induction furnace, close to 100% of the metal charged was recovered as metal in the ingot. Uranium ingots weighing up to 1200 lb were prepared by induction melting U in an atmosphere of A and pouring the melt under a protective cover of molten $BaCl_2$ or $CaCl_2$. When this technique was used, the metal poured quietly and oxidation of the metal was minimized. The average metal recovery from heats weighing 600 to 1200 lb was 91 to 95%. These large ingots were not quite so pure as vacuum-melted ingots. The average C content was 0.04 w/o, and the average N content was 0.010 w/o. Uranium ingots melted in an open furnace at Battelle seemed somewhat stiffer than the normal run of vacuum-melted U ingots when rolled into bars at FMPC. Metallographic examination showed that there were more stringers in the experimental ingots than in the vaccum-melted ingots. (auth)

11652 CC-2954
[Ames Lab., Ames, Iowa.]
EXTRACTION OF URANYL NITRATE AND THORIUM NITRATE BY ORGANIC SOLVENTS, PHYSICAL AND INORGANIC SECTION. O. Johnson and A. S. Newton. Nov. 5, 1945. Decl. Feb. 16, 1957. 7p. Contract W-7405-eng-82. $1.80(ph OTS); $1.80(mf OTS).

The separation of uranyl nitrate from aqueous solutions of 0.635 M thorium nitrate, 3 M nitric acid and 3 M calcium nitrate by extraction with organic solvents was investigated. Solvents which gave good separations were 2-ethyl hexyl acetate, ethyl benzoate, n-butyl ether and β-β dichloroethyl ether. In general, higher esters, ethers, and alcohols are better for separating uranium from thorium than the lower homologues. Several solvents were tested at lower nitric acid concentrations. Dibutyl cellosolve gave a very good separation when the solution was 0.1 M nitric acid. Of the solvent mixtures studied that of equal parts of n-butyl ether and dibutyl cellosolve gave a good separation. (auth)

11653 CF-52-4-64
Oak Ridge National Lab., Tenn.
APPLICATION OF VOLATILITY PROCESSES TO URANIUM RECOVERY. R. E. Leuze. Apr. 14, 1952. Decl. Feb. 16, 1957. 12p. $3.30(ph OTS); $2.40(mf OTS).

The production of U from ores and decontamination of reactor fuels are suggested as applications of volatilization processes for U recovery. (C.W.H.)

11654 CF-52-9-121
Oak Ridge National Lab., Tenn.
PARTICLE SIZE DISTRIBUTION OF PLATELET FORM OF UO_3 AND EFFECT OF HIGH PRESSURE AND TEMPERATURE ON THEIR FORM WHEN FLOWING AS A SLURRY. J. M. DallaValle. Sept. 11, 1952. Decl. Feb. 14, 1957. 18p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

In a study of particle size distribution, it was found that the platelets conform to a logarithmic size distribution, they are fragile, and agitation causes size reduction. Rod-like forms of UO_3 were found unsusceptible to fragmentation, are slowly converted to platelets at 250°C and 1000 psi pressure, and continuous cycling of rod-like slurries causes abrading to uniform ovules which revert to irregular platelets when heated and pressurized. (F.S.)

11655 CF-54-12-6
Oak Ridge National Lab., Tenn.
STATUS OF THE RESEARCH PROGRAM FOR URANIUM CHEMISTRY OF RAW MATERIALS. K. B. Brown. Dec. 2, 1954. Decl. Mar. 14, 1957. 21p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Results are reported from an evaluation of organophosphorus reagents and some other types of organic compounds as extractants for U from acid liquors. (C.H.)

11656 CT-393
[Chicago. Univ. Metallurgical Lab.]
TECHNOLOGICAL RESEARCH, SECTION I REPORT FOR MONTH ENDING DECEMBER 15, 1942. Decl. Feb. 19, 1957. 57p. (A-411). $12.30(ph OTS); $4.50(mf OTS).

The fabrication and metallurgical properties of U metal, preparation and microstructure of uranium carbides, electrolysis of fused salts, physical properties of graphite, coating of U metal, and corrosion of reactor materials by H_2O and molten Bi were studied. (C.W.H.)

11657 CT-2144
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS REPORT ON METALLURGY OF TUBALLOY [URANIUM] TO THE UNIVERSITY OF CHICAGO. Sept. 1, 1944. Decl. Feb. 19, 1957. 19p. $3.30(ph OTS); $2.40 (mf OTS).

Progress is reported on the following studies: x-ray-diffraction determinations of the coefficients of expansion in U crystals; the dimensional stability of γ-extruded and α-rolled U slugs; Ni plating of U and the effectiveness of Ni as a barrier coat; and the effect of annealing following cold rolling on hardness and structure of U. (C.H.)

11658 IDO-14246
American Cyanamid Co. Atomic Energy Div., Idaho Falls, Idaho.
DENSITIES AND BOILING POINTS OF URANYL NITRATE-NITRIC ACID SOLUTIONS. R. H. Perkins. May 6, 1953. Decl. Mar. 14, 1957. 14p. Contract AT-(10-1)-177. $3.30(ph OTS); $2.40(mf OTS).

The boiling points at 635 mm mercury pressure and the densities at 91°C were determined for a series of solutions containing 0.75, 1.5 and 2.0 molar $UO_2(NO_3)_2$ and 0, 2 and 5% HNO_3. The densities of these solutions change by about 0.030 g/ml for a 0.1 molar change in $UO_2(NO_3)_2$ concentration at the boiling point, while the boiling temperature changes 0.2 to 0.5°C for the same change in U concentration. Since variations in barometric pressure may cause the boiling points to change by as much as 1.6°C, it appears that a temperature measuring device offers disadvantages as a primary controller for the intercycle evaporators, but could operate an upper limit cut off for the prevention of over concentration. (auth)

11659 K-398
Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.
RADIOACTIVITY MEASUREMENT OF U-238 AND U-234 IN ENRICHED URANIUM. G. B. Knight and R. L. Macklin. May 9, 1949. Decl. Mar. 29, 1957. 25p. Contract [W-7405-Eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Methods have been described for the determination of U-234 and U-238 in U samples containing in addition a large fraction of U-235. These methods have been de-

signed so that the dependence on mass spectrometer abundance measurements is negligible. The precisions obtained are 1.5% or less. (auth)

11660 K-444
Carbide and Carbon Chemicals Corp. K-25 Lab. Div., Oak Ridge, Tenn.
SPRAY DECOMPOSITION OF URANYL NITRATE SOLUTIONS TO URANIUM TRIOXIDE. A. L. Allen, H. A. Bernhardt, S. Bernstein, R. H. Harrison, E. W. Powell. July 15, 1949. Decl. Feb. 25, 1957. 18p. Contract [W-7405-eng-26]. (KLO-124). $3.30(ph OTS); $2.40(mf OTS).

A method employing the thermal decomposition of atomized $UO_2(NO_3)_2$ solutions has been developed for the preparation of a more reactive UO_3 which is suitable for subsequent conversion to UF_4. The submicron diameter UO_3 produced has a very high surface area and is continuously prepared in a completely closed system. A glass cloth filter is used to remove entrained U oxide dust particles, and a water scrubber is employed to recover the gaseous $UO_2(NO_3)_2$ decomposition products as HNO_3. (auth)

11661 K-819(Del.)
Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.
THE DIRECT FLUORINATION OF BELGIAN CONGO ORE. R. H. Harrison. Sept. 30, 1951. Decl. with deletions Feb. 25, 1957. 14p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

A study was made to determine the feasibility of the removal of U from Belgian Congo Ore by successive treatment of the ore with HF and F. (auth)

11662 KLX-1739
Vitro Labs., West Orange, N. J.
HOMOGENEOUS REACTOR FUEL REPROCESSING BY CaF_2 ADSORPTION OF RARE EARTHS. JOB 1087. Dec. 31, 1954. Decl. Mar. 22, 1957. 30p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 535. $0.35 (OTS).

It was found that contacting simulated reactor fuels with a packed bed containing CaF_2 would selectively remove mixed rare earths added to the feed solution in amounts which correspond to their expected concentration under reactor conditions. Such a process applied to the entire fuel charge of a homogeneous thermal breeder reactor would greatly enhance the neutron economy making possible a high breeding gain. Studies show that the CaF_2 functions by contributing fluoride to the solution, thereby precipitating rare earth fluorides which deposit in the solid bed. Optimum operating conditions for the process are discussed. (auth)

11663 MCW-24
Mallinckrodt Chemical Works, St. Louis.
THE REACTION OF URANIUM DIOXIDE WITH HYDROGEN FLUORIDE TO PRODUCE URANIUM TETRAFLUORIDE, AND RELATED TOPICS. E. I. Miller. Apr. 1, 1946. Decl. Mar. 28, 1957. 22p. $0.30(OTS).

The rate of reaction of UO_2 and HF was investigated as a function of time, temperature, particle size, and gas concentration. (L.T.W.)

11664 WAPD-MM-491
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
RESUMÉ OF URANIUM ALLOY DATA—VI. B. Lustman. Jan. 3, 1955. Decl. Feb. 1, 1957. 54p. $0.50(OTS).

Data are summarized on the corrosion of U–Mo alloy in 343°C H_2O, the corrosion of U–Mo–Pt alloys in 650°F H_2O, the corrosion life of unclad U–Mo–Nb alloys in 650°F H_2O, the corrosion behavior of U–Mo–X alloys in 650°F H_2O, the corrosion life of zircaloy-clad U alloys, dimensional changes in irradiated U–Si alloy specimens, and hardness changes in U–Mo alloys during corrosion testing. Macroscopic observations of UO_2 powders and compacts are also shown. (W.L.H.)

11665 Y-467
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
THE CONVERSION OF URANYL AMMONIUM PHOSPHATE TO URANIUM HEXAFLUORIDE IN A BATCH VAPOR PHASE REACTOR. C. C. Haws. July 27, 1949. Decl. Mar. 6, 1957. 39p. Contract W-7405-eng-26. $6.30 (ph OTS); $3.00(mf OTS).

A preliminary investigation was made of a batchwise process for converting uranyl ammonium phosphate (UAP) to uranium hexafluoride. Processing consisted of forming UAP of controlled moisture content into shapes, loading into a vertical reactor, and then successively performing a hydrogen reduction, a hydrofluorination, and a fluorination. Major problem encountered was that of forming the necessary shapes. (auth)

WASTE DISPOSAL

11666 TID-10126
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
COLUMBIA RIVER SURVEY, 1951, 1952, 1953. J. F. Honstead. July 21, 1954. Decl. Mar. 1, 1957. 92p. Contract W-31-109-eng-52. $0.60(OTS).

The results of sampling and velocity determinations across the Columbia River at numerous locations below Hanford effluent discharge points and during various seasons are presented. A total of 59 such traverses is shown with the observed velocity and effluent distribution patterns for each river profile. A method of normalizing the data to permit closer comparison of the observed patterns at different locations is presented. The method is based upon the use of fractional quantity distributions to avoid the confusing variations in profile shape at different locations. The results of an intensive river survey below the 100-C reactor discharge are shown. These data were collected to permit mathematical analysis of the turbulent diffusion mechanism in the river. One such analysis derived from these data is presented. (auth)

11667 WAPD-PWR-PMA-206
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
GENERAL SPECIFICATION FOR THE PWR COMMERCIAL NUCLEAR POWER PLANT WASTE DISPOSAL EQUIPMENT. E. Spec.-566210-A. [Dec. 12, 1955]. 6p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

ENGINEERING

11668 HW-45008
Hanford Atomic Products Operation, Richland, Wash.
HANFORD USE OF EXPERIMENTAL WATER FILTER PLANT. W. R. Conley, C. W. Botsford, and R. W. Pitman. Aug. 20, 1956. Decl. Mar. 13, 1957. 30p. Contract W-31-109-Eng-52. $0.35(OTS).

An improved method of water plant control has been developed at Hanford which employs a sensitive turbidity measuring microphotometer and a model water filtration plant. The microphotometer operates on a light scattering principle and is accurate in the range of 0.0 to 0.1 ppm turbidity. The model filter plant used is a five gallon per

minute plant which can simulate the conditions normally occurring in the large water plants. It is the purpose of this report to describe the model filter plant and to demonstrate the value of the model and microphotometer for effective water plant control and water plant design scoping. (auth)

HEAT TRANSFER AND FLUID FLOW

11669 ORNL-156
Oak Ridge National Lab., Tenn.
HEAT TRANSFER IN MANHATTAN DISTRICT AND ATOMIC ENERGY COMMISSION LABORATORIES: A CRITICAL SURVEY. W. B. Harrison. Oct. 1, 1948. Decl. Mar. 6, 1957. 274p. Contract W-7405-eng-26. $1.10(OTS).

An effort was made to study, correlate, and bring together in one volume the heat transfer data found in reports of the Manhattan Project and in the continuing activities of the Atomic Energy Commission. Information was categorized on the basis of its common nature such as the state of the medium, solid, liquid, gas; and the nature of the heat transfer, conduction, convection, turbulent flow, boiling. The physical properties of the mediums considered and references to source material are also given. (D.E.B.)

MATERIALS TESTING

11670 HW-38016
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
MECHANIZATION OF NONDESTRUCTIVE TESTS. F. B. Quinlan. Apr. 11, 1955. Decl. Apr. 1, 1957. 32p. Contract W-31-109-Eng-52. $0.35(OTS).

The equipment necessary for the nondestructive tests for Hanford fuel elements is discussed. It is shown that a mechanism can handle, with care and speed, many parts per day and thus avoid the human error that accompanies industrial fatigue. (W.L.H.)

11671 KAPL-M-EDL-34
Knolls Atomic Power Lab., Schenectady, N. Y.
HYDRAULIC CHARACTERISTICS OF 2" POWELL ANGLE BELLOW VALVES. D. J. Eldredge. Mar. 3, 1953. 16p. Contract [W-31-109-eng-52]. $3.30(ph OTS); $2.40(mf OTS).

WASTE DISPOSAL

11672 KLX-015(Del.)
Kellex Corp., New York.
BULK STORAGE OF RADIUM CAKE—PRELIMINARY COST ESTIMATES. June 15, 1949. Decl. with deletions Feb. 26, 1957. 30p. Contract AT-30-1-GEN-169. $6.30 (ph OTS); $3.00(mf OTS).

Two alternates were considered for transferring radium cake from the point of manufacture to the place of storage. The cake produced in drums should be emptied individually into a storage basin, and the slurry should be put in a tank car for future pumping into a storage basin. As a result of this cost study, it is recommended that bulk storage loading be accomplished by the tank car transfer of radium cake in slurry form. The tank car transfer method is more attractive from an engineering viewpoint than the drum transfer method, but the capital investment of this system is much higher. (F.S.)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

11673 BMI-X-134
Battelle Memorial Inst., Columbus, Ohio.
STATUS OF AN ALTERNATE CONTROL MATERIALS PROGRAM. R. W. Dayton. Dec. 15, 1956. Decl. Feb. 14, 1957. 13p. $3.30(ph OTS); $2.40(mf OTS).

Mechanical properties of clad and unclad B-Ti and B_4C-Ti cermets and the corrosion resistance of defected clad compacts of these combinations was investigated. Primary emphasis was placed upon a 26 wt. % B in Ti dispersion and a 35 wt. % B_4C in Ti dispersion. One compact of each of these compositions was prepared by hot pressing green compacts sealed in mild steel frames at 1500°F. These specimens are being machined and will be clad by pressure bonding techniques. After cladding the specimens will be defected and corrosion tested in 680°F water. (auth)

CORROSION

11674 BMI-971
Battelle Memorial Inst., Columbus, Ohio.
CORROSION EVALUATION OF BINARY URANIUM ALLOYS IN WATER AT 100 C. H. A. Saller, H. A. Pray, R. F. Dickerson, W. E. Berry, and E. L. Foster, Jr. Dec. 27, 1954. Decl. Mar. 1, 1957. 38p. Contract W-7405-eng-92. $0.35(OTS).

The corrosion behavior in boiling water of a number of uranium binary alloys was determined. Additions ranging from 2 to 12 at. % of some 42 elements and effect of heat treatment on corrosion resistance were investigated. The alloying was done in an arc furnace designed particularly to expedite melting of a large number of alloys. Melting characteristics, fabrication temperatures, and heat-treatment temperatures for each alloy were noted. Vickers hardness numbers of all alloys and data on grain size of the more corrosion resistant alloys were also obtained. (auth)

11675 CF-52-1-181
Oak Ridge National Lab., Tenn.
A MICROSCOPIC STUDY OF OXIDE FILMS FORMED ON CHROME–IRON CONTAINING APPROXIMATELY 1.25% COPPER EXPOSED TO 0.17 M URANYL SULFATE SOLUTION AT 250°C FOR 12 WEEKS. T. E. Willmarth and F. D. McNeer. Jan 23, 1952. Decl. Feb. 14, 1957. 17p. Contract [W-7405-eng-26]. $0.30(OTS).

A tube section of No. 443 chrome-iron with 1.25% Cu addition was immersed for 12 weeks in a 0.17M UO_2SO_4 solution at 250°C. No passivation pretreatment was used. The oxide film formed in contact with the metal substrate appeared to meet the conditions essential for a protective film. The presence of Cu^{2+} in the metal alloys assisted the formation of the film. The addition of Cu to other steels, preferably of the 300 series, also produced a material relatively free from corrosion attacks in UO_2SO_4 solution. (D.E.B.)

11676 CF-53-2-234
Oak Ridge National Lab., Tenn.
SUMMARY OF EXPERIMENTS ON THE INHIBITION OF CORROSION BY THE PERTECHNETATE ION. G. H. Cartledge. Feb. 24, 1953. Decl. Feb. 14, 1957. 8p.

Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

11677 CF-56-2-3
Oak Ridge National Lab., Tenn.
CORROSION OF STAINLESS STEEL BY URANYL SULFATE SOLUTIONS FREE OF STAINLESS STEEL CORROSION PRODUCTS. A. L. Bacarella. Feb. 9, 1956. Decl. Mar. 16, 1957. 17p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

Apparatus is described which was used in a study of the corrosion of stainless steel by uranyl sulfate solutions in a system in which the products of corrosion do not accumulate. A schematic drawing of the open ended loop equipment is included. The solution for all experiments was approximately 0.17 molal UO_2SO_4. The experimental conditions for each run and the corrosion results for each are summarized. Results are compared with results obtained in rocking bomb and in static autoclave bomb experiments. (C.H.)

11678 CF-56-2-88
Oak Ridge National Lab., Tenn.
HRP DYNAMIC CORROSION STUDIES. SUMMARY OF RUNS N-16 AND 17: 0.4 M $-UO_2SO_4$ WITH 0.4 M $-Li_2SO_4$ AT 300 AND 250°C. J. C. Griess, R. S. Greeley, and S. R. Buxton. Feb. 17, 1956. Decl. Mar. 16 1957. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The corrosive effects of $UO_2SO_4-Li_2SO_4$ on stainless steels, Ti, and Zircaloy were determined. (D.E.B.)

11679 CF-56-2-89
Oak Ridge National Lab., Tenn.
HRP DYNAMIC CORROSION STUDIES. SUMMARY OF RUN D-62: 2.7m UO_2SO_4 PLUS 3.0m Li_2SO_4 AT 200°C. J. C. Griess, R. S. Greeley, and S. R. Buxton. Feb. 17, 1956. Decl. Mar. 16, 1957. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Corrosive effects on stainless steel, Ti, and Zircaloy-2 were determined. (D.E.B.)

11680 CF-56-2-134
Oak Ridge National Lab., Tenn.
HRP DYNAMIC CORROSION STUDIES. SUMMARY OF RUN E-57: DESCALING LOOP E WITH CHROMOUS SULFATE SOLUTION. J. C. Griess, R. S. Greeley, and S. R. Buxton. Feb. 24, 1956. Decl. Mar. 16, 1957. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Corrosion product removal from Ti, stainless steel, and Stellite was measured. (D.E.B.)

11681 CF-56-2-146
Oak Ridge National Lab., Tenn.
HRP DYNAMIC CORROSION STUDIES. SUMMARY OF RUN H-84 DEFILMING RUN WITH CHROMOUS SULFATE. J. C. Griess, R. S. Greeley, and S. R. Buxton. Feb. 29, 1956. Decl. Mar. 16, 1957. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Corrosion product removal from Ti, stainless steel, Stellite, and Zircaloy-2 was measured. (D.E.B.)

11682 CF-56-4-138
Oak Ridge National Lab., Tenn.
SOLUTION CORROSION GROUP QUARTERLY REPORT FOR THE PERIOD ENDING APRIL 30, 1956. J. C. Griess, H. C. Savage, J. L. English, R. S. Greeley, S. R. Buxton, R. M. Warner, and R. M. Pierce. Apr. 30, 1956. Decl. Mar. 14, 1957. 38p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

The all-Ti loop has been modified to simplify operation. A new stainless steel loop is being constructed to circulate UO_2SO_4 solutions containing $BeSO_4$. Further testing with $Li_2SO_4-UO_2SO_4$ solutions has been completed. Additional testing at 250°C in a solution containing 0.03m UO_3 in 0.17m Li_2CO_3 with O_2 and CO_2 overpressure was completed. The 4,000 gpm loop has been used to make two runs at 250°C with a solution similar to that proposed for use in the HRT. Four 100A loops have been descaled with a descaling solution. The susceptibility of type 347 stainless steel to stress corrosion cracking was demonstrated by spraying tap water on bent pipes through which 153°C steam was passed. Elgiloy, which had shown good corrosion resistance to UO_2SO_4 solutions at 300°C, has shown on continued testing a marked tendency toward stress corrosion cracking both in the solution and in the gas phases. A number of high-strength Ti alloys have been tested in a variety of UO_2SO_4 solutions both in the stressed and annealed condition. (L.T.W.)

11683 CF-56-10-6
Oak Ridge National Lab., Tenn.
HRT CORROSION SAMPLE DATA AND FABRICATION – HEAT EXCHANGER. D. B. Weaver. Oct. 1, 1956. 9p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

All pertinent design data and detailed information pertaining to the sample holders and samples installed in the heat exchangers of the HRT are listed. (L.T.W.)

11684 ORNL-315
Oak Ridge National Lab., Tenn.
SCALE FORMATION STUDIES OF WATER-COOLED ALUMINUM HEAT TRANSFER SURFACES. R. Van Winkle. May 31, 1949. Decl. Mar. 8, 1957. 72p. Contract W-7405-eng-26. $0.45(OTS).

Studies were carried out on the development of a water treatment which would allow an active assembly of the high flux pile to operate for about 30 days without forming a scale with heat-transfer coefficient below 27,000 Btu/hr-ft^2-°F; to measure scale formation on Al under various conditions; and to determine maximum allowable concentration of Fe and Al in the water to prevent scale deposition. (C.H.)

11685 TID-5364
Johns Hopkins Univ., Baltimore. Inst. for Cooperative Research.
ELECTRICAL STUDIES OF SURFACE FILMS. Report No. 2 [on] MEASUREMENT OF THICKNESS OF THIN OXIDE FILMS. John M. Kopper. Oct. 30, 1953. Decl. Mar. 6, 1957. 20p. For Westinghouse Electric Corp. [Atomic Power Div.] Contract AT-11-1-GEN-14, Subcontract No. 14-328. $3.30(ph OTS); $2.40(mf OTS).

The work done to date on the problem of measuring the thickness of thin oxide films by an electrical capacitance technique is summarized. Graphs and tables are prepared to show the results. (C.H.)

11686 WAPD-C(PC)-18
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
CORROSION OF STRUCTURAL MATERIALS IN CHEMICAL CONTROL SOLUTIONS. Interim Report. Paul E. Brown. Aug. 25, 1954. Decl. Mar. 6, 1957. 28p. $0.35 (OTS).

The results of corrosion testing of various structural materials in chemical control solutions are tabulated. All tests were screening tests performed at 650°F. (auth)

METALS AND METALLURGY

11687 ANL-4966(Del.)
Argonne National Lab., Lemont, Ill.
METALLURGY DIVISION QUARTERLY REPORT [FOR]

OCTOBER, NOVEMBER, AND DECEMBER, 1952. Dec. 31, 1952. Decl. with deletions Feb. 11, 1957. 66p. Contract W-31-109-eng-38. $10.80(ph OTS); $3.90(mf OTS).

Progress is reported on the following studies: Zr cladding of U by roll bonding, manufacture of experimental U–Zr alloy slugs for EBR, melting of U, melting of co-reduced U–Zr alloy biscuits, fast β treatment of U rod by induction, mechanical properties of polycrystalline U, deformation of U single crystals at room temperature, preferred orientation in rolled U rod, effect of high reductions at 300°C on thermal cycling growth of U, preparation of high-purity U–Zr alloys, thermal cycling of U, effect of irradiation on U–stainless steel diffusion couples, preparation of urania refractories, the urania–thoria binary system, corrosion of Al at elevated temperatures, solution potentials of Al in dilute aqueous solution, aqueous corrosion of Zr and U, thermal cycling of Sylvania hot-pressed Hanford size slugs, electrolytic refining of Th, and radiation effects on U and its alloys. (D.E.B.)

11688 ANL-5257(Del.)
Argonne National Lab., Lemont, Ill.
METALLURGY DIVISION QUARTERLY REPORT FOR JANUARY, FEBRUARY, AND MARCH 1954. Mar. 31, 1954. Decl. with deletions Feb. 12, 1957. 63p. Contract W-31-109-eng-38. $10.80(ph OTS); $3.90(mf OTS).

Progress is reported on the following studies: cast bonding of U–Zr–Nb alloy to Zircaloy; casting of U alloys (U–Nb–Zr, U–Nb, and U–Zr); corrosion and thermal conductivity of Al–Zr, Ti–Zr, and Al–Ti alloys; self-diffusion in U; deformation of α U single crystals; preparation and metallography of C–U alloys; heat treatment, microstructure, and nature of the ϵ phase of U–Zr alloys; zone melting and phase studies of U alloys; diffusion coatings (β USi_2) of Si in U; thermal cycling of U slug elements; effect of irradiation on U–Zr and Nb–U alloys and 347 stainless steel; corrosion of Al in 300°C degassed distilled water and in high-temperature sulfuric acid containing inhibiting ions as a function of pH; aqueous corrosion of U–Zr alloys at 300°C; and the effect of high-temperature aging on corrosion resistance of Nb–Sn–U–Zr alloys. (W.L.H.)

11689 ANL-5563
Argonne National Lab., Lemont, Ill.
METALLURGY DIVISION QUARTERLY REPORT [FOR] JANUARY, FEBRUARY, AND MARCH 1956. June 1956. Decl. Feb. 12, 1957. 56p. Contract W-31-109-eng-38. $0.50(OTS).

The fabrication and measurement of clad thickness of EBWR fuel plates were studied. Examination of irradiated EBR prototype fuel element, effect of alpha annealing on the irradiation growth rates of wrought U–Zr alloys, and the expansion coefficients of some Pu alloys are reported. Work on the examination of Al–Ni alloy plates from corrosion test in water loop, and high temperature aqueous corrosion of Al alloys was continued. The preparation of the U crystals for elastic constants studies, the delta phase in U–Zr alloys, phase diagram of Nb–U–Zr alloys and corrosion mechanism of Al and Zr are presented. (For preceding period see ANL-5541.) (L.M.T.)

11690 CT-3229
[Massachusetts Inst. of Tech., Cambridge.]
PROGRESS REPORT FOR THE MONTH OF AUGUST 1945. Sept. 12, 1945. Decl. Feb. 20, 1957. 16p. Contract W-7405-Eng-175. $3.30(ph OTS); $2.40(mf OTS).

Progress is reported on the manufacture of sulfide crucibles, production of MgO crucibles, and calcination of non-porous BeO, and ThO_2 crucibles. The casting of Be hemispheres in vacuo with curved surface down and a hot-top above was successful. Cast billets and pressed flake compacts were hot pressed into flats and then rolled into plates. Aluminum alloys with 3% B were cast from 1500°C, but there is still 3 to 4% porosity. (W.L.H.)

11691 BBC-24
Brush Beryllium Co., Cleveland.
FIN TUBE PROJECT AND G. E. WASHER PROJECT PROGRESS REPORT FOR THE PERIOD OF AUGUST 1 TO AUGUST 31, 1948. D. T. Doll. Decl. Mar. 15, 1957. 26p. Contract AT-30-1-Gen-155. $4.80(ph OTS); $2.70(mf OTS).

Four runs were made to fabricate fin tubes by sintering Be metal powder. The general procedure, established in previous fin tube work, was used in this work. A formed sheet metal envelope with spiral core in place was filled with metal powder. The filled tube was welded closed with access to the core only and pressure tested. The envelope assembly was then placed in the pressure chamber. The space between the envelope and pressure chamber was packed with either alundum or silicon carbide powder (60 mesh) to prevent the tube from twisting. The envelope was evacuated and placed under 100 psi and external gas pressure using A gas. The powder was then sintered at either 1050° or 1100°C. None of the tubes produced were pressure tight over the entire tube length. In one case, the tube was found to be cracked for a length of 5 inches. In several instances, parts of the outer edges of the tube fins had broken away. This effect was thought to be due partly to the deformation, occurring in the envelope during sintering, which tends to pinch off the edge of the fin, and partly to a powder deficiency in the fin sections. Compacts were made by compressing Be metal powder under 80 psi to Plan 2 washer design. Five compacts were placed alternately between steel plungers to form a column. The plunger-compact arrangement was located in a steel holding die and the assembly placed in a sintering furnace. The sintering chamber was evacuated and the compacts were hot pressed under 1500 psi for 3 hours at 1050°C. The sintered washers ranged in density from 1.772 to 1.856. The impurity level (based on powder and sintered washer analyses) showed an increase in Fe of from 30 to 180%, and in slag from 300 to 425%. The BeO content remained about the same. The increase in iron content can be attributed to the tendency of the Be and steel to alloy. A number of washers were made by warm pressing metal discs to Plan 2 washer design. Circular metal blanks, cut from sintered rod, were brought to a temperature of 425°C in a heated mold and die assembly and pressed under 100 psi using tungsten carbide tools. Washers fabricated by this method possessed very good detail in the impression, a smooth surface and densities on the order of 1.87. Failure of one of the plungers prevented investigation of the method for other than the one temperature. Further study of the procedure will be made. (auth)

11692 BBC-47
Brush Beryllium Co., Cleveland.
FABRICATION BY POWDER METALLURGY. Progress Report [for] January 1, 1949 through June 30, 1949.
C. G. Hoffman and W. W. Beaver. Decl. Mar. 12, 1957. 66p. Contract AT-(30-1)-510. $10.80(ph OTS); $3.90(mf OTS).

Fabrication of special Be metal forms by several methods of powder metallurgy is described. Trifluted spacers, rods, flat bars, and eight-finned tubes were fabricated by an envelope technique; fluted retainers and Be–U compacts by warm-pressing and sintering; rods by an extru-powder process; and disks by hot-pressing. (G.Y.)

11693 BMI-915
Battelle Memorial Inst., Columbus, Ohio.
HEAT TREATMENT AND PROPERTIES OF THE URA-

NIUM-5 w/o ZIRCONIUM ALLOY. H. A. Saller, F. A. Rough, and A. A. Bauer. May 17, 1954. Decl. Mar. 1, 1957. 28p. Contract W-7405-eng-92. $0.35(OTS).

The transformation of the uranium–5 wt.% zirconium alloy during heat treatment is an important aspect of the alloy's behavior. Quenching from the gamma-uranium solid-solution region is necessary to minimize corrosion in 100°C water. In this quenched condition, the alloy is hard and difficult to fabricate. In larger sections, the stresses built up during quenching can cause warping and rupture. Isothermal heat treatments appear to be the most effective means of avoiding these effects, without altering the good corrosion resistance. (auth)

11694 BMI-929
Battelle Memorial Inst., Columbus, Ohio.
EVALUATION OF METHODS OF BRAZING ALUMINUM SPACING FINS TO FLAT-PLATE ALUMINUM-CLAD FUEL ELEMENTS. R. M. Evans and D. C. Martin. July 23, 1954. Decl. Feb. 14, 1957. 12p. Contract W-7405-Eng-92. $0.25(OTS).

Four brazing methods and one other joining process were evaluated for the joining of aluminum spacer fins to flat-plate aluminum-clad fuel elements. None of these methods appear completely suitable for use in a mass-production operation. Furnace brazing and salt-bath brazing were most promising. However, the mechanical problems involved in the application of either process deter their recommendation. Resistance brazing and torch-brazing were proven impractical. The great difference in mass between the two pieces being joined prevents the use of either the resistance or torch method. Pressure bonding is not applicable because of the excessive deformation of parts being joined. (auth)

11695 BMI-1068(Del.)
Battelle Memorial Inst., Columbus, Ohio.
THE PROPERTIES OF URANIUM CONTAINING MINOR ADDITIONS OF CHROMIUM, SILICON, OR TITANIUM. Henry A. Saller, Frank A. Rough, and Walston Chubb. Jan. 30, 1956. Decl. with deletions Feb. 12, 1957. 28p. Contract W-7405-eng-92. $4.80(ph OTS); $2.70(mf OTS).

Tensile tests on alloys of uranium show that those containing 0.35 at.% chromium and 1.5 at.% silicon are about 30% stronger than arc- or induction-melted uranium. The ductility of the 0.35 at.% chromium alloy is similar to that of arc-melted uranium, but the 1.5 at.% silicon alloy has only about two-thirds of the ductility of arc-melted uranium. A 0.5 at.% titanium alloy was not significantly different from uranium. All alloys were found to have similar thermal conductivities and thermal-expansion properties. Beta treatment of alpha-rolled stock was found to cause an increase in grain size and an increase in hardness in all alloys. Annealing the alloys at 600°C after beta quenching was found to soften the alloys and made the grains equiaxed without causing any change in grain size. Microstructures show that arc-melted uranium has a larger grain size and lower inclusion count than induction-melted uranium. (auth)

11696 CF-55-1-53
Oak Ridge National Lab., Tenn.
STATUS OF THE METALLEX PROCESS. R. E. Blanco. Jan. 10, 1955. Decl. Feb. 15, 1957. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The Metallex Process for the production of metallic Th is discussed and its flowsheet is given. (J.E.D.)

11697 CF-56-9-121(Del.)
Oak Ridge National Lab., Tenn.
A LITERATURE REVIEW AND TENTATIVE PROGRAM FOR INVESTIGATING ACTIVE METAL REACTIONS WITH URANYL SULFATE SOLUTIONS. J. P. Hammond and G. M. Adamson. Sept. 20, 1956. Decl. with deletions Feb. 13, 1957. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

11698 CP-3445
Chicago. Univ. Metallurgical Lab.
PHYSICS AND METALLURGY DIVISION REPORT FOR MONTH OF FEBRUARY 1946. Feb. 27, 1946. Decl. Mar. 13, 1957. 10p. Contract W-7401-eng-37. $1.80 (ph OTS); $1.80(mf OTS).

Copper-jacketed ingots of U–Th alloys were successfully extruded at any temperature between 625 and 800°C; the pressure required is about 50 tsi. Be alloys were extruded satisfactorily and could be extruded in hexagonal shape with good bonding between Be alloy core and shell. Be–U alloy may be rolled into 0.060 in sheet at 1000°C without cracking. The weight-change rates of 19 alloys of U base were made. A source for the mass spectrometer for fission product isotopes in Ge, Sb, Sn, and Te was developed. Ba carbonate, Be, and Cu were analyzed. (F.S.)

11699 HW-28282
Hanford Atomic Products Operation, Richland, Wash.
REMOVAL OF THE COMPOUND LAYER FROM DE-CANNED HANFORD URANIUM SLUGS BY THE USE OF SODIUM HYDROXIDE. H. L. Brandt and H. P. Kraemer. May 15, 1953. Decl. Feb. 19, 1957. 6p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

In a laboratory-scale investigation of sodium hydroxide removal of the compound layer from de-canned, triple-dipped, and lead-dipped U slugs, a 50% caustic solution readily removed the compound layer. (F.S.)

11700 ISC-36
Ames Lab., Ames, Iowa.
PROGRESS REPORT IN METALLURGY FOR APRIL 1, 1948 TO SEPTEMBER 30, 1948. F. H. Spedding. Dec. 30, 1948. Decl. Mar. 28, 1957. 40p. Contract W-7405-eng-82. $6.30(ph OTS); $3.00(mf OTS).

Progress is reported on the hydrofluorination, purification, production, and physical property studies of Th and Th compounds. Experiments in Be reduction are also reported. The production of metallic Zr and Zr alloys is discussed. Rare earth and alloy studies are summarized. (M.H.R.)

11701 ISC-300(Del.)
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT IN METALLURGY FOR JULY, AUGUST AND SEPTEMBER 1952. Dec. 1, 1952. Decl. with deletions Feb. 26, 1957. 33p. Contract W-7405-eng-82. $6.30(ph OTS); $3.00 (mf OTS).

Progress is briefly reported on the following studies: Hf–Zr separation, Zr metal by bomb reduction, Zr–Sn alloy corrosion, resistance-temperature measurements on Nb–Zr alloy, eutectoid at 790°C in Zr–V alloy, phase studies on Zr–Zn alloys, Th production, Th oxalate precipitation, ThF_4 preparation, phase studies of Th–Mg, Th–V, Th–Zr, and Th–Nb alloys, leaching of Nb and Ta ore, separation of rare-earth mixtures, the Ti–V and Al–V systems, electric resistivity of Th, casting U into metal sleeves, Zr coating of Th by vapor decomposition of ZrI_4, coating of U, determination of O_2 in metals. (L.T.W.)

11702 ISC-314(Del.)
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT [FOR] OCTOBER–DECEMBER 1952. P. Chiotti and O. N. Carlson. Jan. 1953. Decl. with deletions Feb. 26, 1957. 26p. Contract W-7405-eng-82. $4.80(ph OTS); $2.70(mf OTS).

A study is made of the preparation of corrosion-resistant

U slugs for the purpose of reducing the frequency of fuel element failures. Electrodeposition of Al on Cu plated U, coating of U with Sn, diffusion coating and vapor phase deposition of Zr, Nb and Mo on U and Th, slug casting into Zr, Nb and Ni cans are considered. The constitution diagrams, corrosion and mechanical properties of Nb–U, Mo–U, Nb–U–Zr, Mg–U and Zn–Zr systems are studied. The thermal conductivity of U from thermal diffusivity measurements and by standard engineering methods, the preparation of Nb and the production of cast U slugs are reported. (J.E.D.)

11703 ISC-396(Del.)
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT IN METALLURGY FOR APRIL, MAY, AND JUNE 1953. Nov. 16, 1953. Decl. with deletions Feb. 26, 1957. 35p. Contract W-7405-Eng-82. $6.30(ph OTS); $3.00(mf OTS).

Progress is reported on the following investigations: separation of Hf from Zr and Zr from Hf; preparation of ZrF_4 from $ZrO(OH)_2$ or $ZrCl_4$; bomb reduction of ZrF_4 and HfF_4; phase studies of Nb–Zr, V–Zr, and Zn–Zr alloys; preparation of $ThCl_4$; reduction of ThO_2; melting and casting of Th; crystal structure of Th; phase studies of Mg–Th, Ti–Th, Nb–Th alloys and C–Th systems; treatment of ores containing Nb and Ta; separation of Nb and Ta and of the rare earths by liquid-liquid extraction; reduction of Nb_2O_5 with C or Ca; reduction of UO_3; preparation of VF_5; phase studies of U–Mg alloys; properties and preparation of U–Nb alloys; phase studies of Nb–V and Al–V alloys; resistance-temperature measurements of U–Nb alloys; casting U onto Nb–U alloys; coating U; solubility of U in Th–Mg eutectic; corrosion resistance and hardness of U–Zr–Nb alloys; hardness of Ta–V alloys; crystal structure of V at high temperatures; solubility of U–Cr alloys in Th–Mg eutectic; corrosion of Ta, Zr, and Nb by liquid Th–Mg alloys; etching of metals by ionic bombardment; separation of optically active isomers of racemic mandelic acid; and investigation of the pyrophoric film formed on U–Zr alloys by pickling in HNO_3. (C.H.)

11704 ISC-506(Del.)
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT IN METALLURGY FOR APRIL, MAY, AND JUNE 1954. Dec. 8, 1954. Decl. with deletions Feb. 26, 1957. 25p. Contract W-7405-eng-82. $4.80(ph OTS); $2.70(mf OTS.

The fusion of niobite–tantalite ore with NaOH, KOH, Na_2O_2, and KNO_3 was studied. The work on the effect of excess of HF on the separation of Ta and Nb and the separation of Hf from Zr was continued. Vanadium metal powder was prepared by reaction of VCl_5 with Mg at 800°C under an inert atmosphere. Niobium was prepared by the co-reduction of Nb_2O_5 and ZrO_2 using Ca and Al as reducers. An analysis was made of the liquidus for the Zr-rich end of the U–Zn system. A brief study was reported of the following alloys: U–Zn, Ag–Cr–U, Th–U, Nb–U, Nb–Zr, V–Zr, Zn–Zr, Ta–Zr, and Zr–Ge. The corrosion of Ta by U–Cr eutectic containing additions of various elements is described. The elasticity of single crystals of Zn and the structure of Al–V intermetallic phases were studied. Investigations of the pyrophoric film formed on U alloys by pickling in HNO_3 and the immiscibility of U and Y were made. (J.E.D.)

11705 JE-51-6
Aluminum Co. of America. Alcoa Process Development Labs., New Kensington, Penna.
DEVELOPMENT OF METHODS FOR SLUG CANNING. R. M. Johnson. July 9, 1951. Decl. Feb. 27, 1957. 21p. $0.35(OTS).

Slugs were sealed in 2S Al impact-extruded cans by closing the open end over a flat disc and welding shut the formed hole. A final hole diameter of $^3/_{16}$ in. was determined as the optimum for both forming and welding. Welding was most easily done by immersing the can in 6 to 7 in. of H_2O and using the inert gas metal arc (tungsten) method with 2S filler wire. A $^1/_8$-in. deep cavity in the top surface of the slug permits the disc to be depressed, forming a cavity for the weld metal. This produces a level top without removal of weld metal, allowing the cans to be butted together. (auth)

11706 KAPL-M-AJB-2
Knolls Atomic Power Lab. Schenectady, N. Y.
FABRICATION OF THE FIRST OF TWO Y SHAPED ROD EXTRUSION BILLETS. Completed Report. A. J. Brown. Nov. 26, 1956. 14p. Contract W-31-109-Eng-52. $3.30 (ph OTS); $2.40(mf OTS).

A completed project report for the first of two Y shaped rod extrusion billets fabricated and assembled for the SAR is presented. An outline of billet parts, the assembly of billet parts, the application of fixtures to fabricate special components, and the employment of special techniques required to make defective parts useful is given. A complete collection of operational process charts used is included. (auth)

11707 KAPL-M-GJS-1
Knolls Atomic Power Lab., Schenectady, N. Y.
MECHANICAL PROPERTIES OF STELLITE 3 AND STELLITE 6. C. J. Sokol and R. L. Mehan. June 5, 1956. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Specimens of Stellite 3 and Stellite 6 were tested as conventional tensile and cyclic strain fatigue specimens. Metallographic examination and a crude thermal shock test were also performed. Stellite 3 was found to be so brittle that it was not possible to mechanically test it. Stellite 6 withstood 70,000 cycles at a strain change of 0.49%. The tensile test results of Stellite 6 indicated that the tensile and yield strengths were high, while the reduction in area and elongation were extremely small. It was concluded that Stellite 6 was superior to Stellite 3 in any application involving thermal shock. (auth)

11708 KAPL-M-JMG-1
Knolls Atomic Power Lab., Schenectady, N. Y.
WELDING OF TITANIUM AND TITANIUM ALLOYS CONTAINING BORON. Final Report. J. M. Gerken. July 17, 1956. 8p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Four Ti–B systems with B content ranging from 0.29 to 1.71 wt. % and two Ti–Al–V–B systems (B–1.0, Al–2.5, V–15, and B–1.0, Al–6.0, V–4.0 wt. % were investigated. The hardness was increased, in all systems, and the ductility decreased by welding. The ductility could be restored by heat treatment. The Ti–Al–V–B system had higher strength and ductility than the Ti–B system. (M.H.R.)

11709 LA-1178
Los Alamos Scientific Lab., N. Mex.
DEVELOPMENT OF FORGING TECHNIQUES FOR URANIUM. R. E. Anderson, J. M. Taub, and D. T. Doll. Nov. 1, 1950. Decl. Feb. 11, 1957. 50p. Contract W-7405-eng-36. $0.45(OTS).

U has been successfully forged using a Lobdell-Nazel forging hammer and a forging temperature range of 500 to 650°C. With standard forging techniques, the metal readily flowed at the temperature chosen. A noticeable increase in tensile strength, yield strength, and % elongation was obtained in forged metal as compared with cast metal. To obtain complete recrystallization and uniform grain size,

a minimum of approximately 75% reduction in cross section by forging followed by an anneal is required. Several protective coatings have been tested and several furnace changes made to prevent oxidation of the meta.. Electroplating, canning, dipping, use of an argon atmosphere and a molten lead bath have all been discarded in favor of K and Li carbonates. Accountability checks have been made during the program. An average weight loss of 0.48% has been recorded using uncoated U and the salt bath as a heating medium. The greater part of this U loss accumulates as a sludge at the bottom of the salt bath and its recovery should not be too great a problem. 31 figures. (C.H.)

11710 NMI-1148
Nuclear Metals, Inc., Cambridge, Mass.
ATOMIC POWER DEVELOPMENT ASSOCIATES PROGRESS REPORT. Final Report Covering Work through December 31, 1955. R. Evans, L. Minnick, A. Boltax, and R. Duncan. June 6, 1956. Decl. Jan. 25, 1957. 31p. $0.25.

An investigation is presented of the fabrication of a fuel element using casting and forging techniques. The purpose was to develop a method of casting an element which contained suitable coolant passages from one of two alloys, U–Cr (eutectic) and U–Zr. This element was typed a "radiator" element and contained tubing 0.165 in. OD, spaced 0.195 in. on centers. (W.L.H.)

11711 NMI-2035
Nuclear Metals, Inc., Cambridge, Mass.
FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. Progress Report for June, 1955. June 28, 1955. Decl. Feb. 27, 1957. 12p. Contract AT(30-1)-1565. $0.15(OTS).

The work on Be–BeO systems, uranium and thorium metallurgy, corrosion tests in 680°F water and 750°F steam on tin–zirconium alloys, corrosion resistance of Sn, and vanadium alloy studies is briefly outlined. (J.E.D.)

11712 MonT-342
[Clinton Labs., Oak Ridge, Tenn.]
THE DIFFUSION OF FISSION PRODUCTS IN ALUMINUM. Final Report. G. Ascoli. July 14, 1947. Decl. Mar. 8, 1957. 24p. Contract WO35-038-eng-71. $4.80(ph OTS); $2.70(mf OTS).

The possibility of contaminating the cooling water of the proposed high-flux pile by the diffusion of fission products through the Al cladding of the active sandwich was investigated both theoretically and experimentally. Calculations showing that diffusion through Al at 90°C will be too slow to contaminate the cooling water were corroborated by experimental results. (auth)

11713 NYO-3575
New York Operations Office, AEC.
NON-DESTRUCTIVE TESTING OF URANIUM SLUGS. Summary Report for April 1952. Richard Hochschild. May 12, 1952. Decl. Feb. 28, 1957. 13p. $3.30(ph OTS); $2.40(mf OTS).

11714 NYO-3578
New York Operations Office, AEC.
NON-DESTRUCTIVE TESTING OF URANIUM SLUGS. Summary Report through May 1953. Richard Hochschild. June 4, 1953. Decl. Feb. 27, 1957. 37p. $0.40(OTS).

Test methods are described for the detection of cracks, inclusions, and striations in bare slugs by eddy currents and ultrasonics, the determination of grain size and crystal orientation by vibration techniques, and the detection of unbonded regions in canned fuel elements. (auth)

11715 TID-10099
Nuclear Metals, Inc., Cambridge, Mass.
FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. PROGRESS REPORT FOR APRIL 1955. May 4, 1955. Decl. Mar. 4, 1957. 12p. Contract AT(30-1)-1565. $0.25(OTS).

Recent investigations in the following areas or metallurgical research and development are reviewed: ductility and corrosion of Be and Be alloys; fabrication and heat treatment of U–Zr alloys; corrosion of U–Si systems; extrusion of U–Mo alloys; bonding between Zr and U–Mo alloys; end-closures for extruded Al-clad Th; production of zircalloy tubing; corrosion of Zr–Sn alloys and Cr–Si steels; and non-reactor metallurgical research. (C.W.H.)

11716 WAPD-127
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
DEVELOPMENT AND PROPERTIES OF URANIUM-BASE ALLOYS CORROSION RESISTANT IN HIGH TEMPERATURE WATER. PART I. ALLOYS WITHOUT PROTECTIVE CLADDING. W. A. Bostrom, M. W. Burkart, E. K. Halteman, R. D. Leggett, R. K. McGeary, and T. R. Padden. Apr. 25, 1955. Decl. Feb. 6, 1957. 164p. Contract AT-11-1-GEN-14. $0.85(OTS).

The status of work is presented on the development of U-base alloys that are corrosion resistant in high temperature water. Binary and ternary alloys of Mo, Nb, Si, Zr, Ge, and other elements have been studied, and their properties, phase relationships, and corrosion resistance are summarized. (C.H.)

11717 WAPD-133
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
URANIUM ALLOYS: THEIR PREPARATION AND FABRICATION AS ZIRCALOY-2 CLAD FUEL RODS. W. B. Haynes. Jan. 31, 1956. Decl. Feb. 7, 1957. 49p. Contract AT-11-1-GEN-14. $0.45(OTS).

Alloys of U–Nb, U–Nb–Pt, U–Mo, and U–Mo–Pt were successfully duplex melted. These alloys were co-extruded in Zircaloy-2, cold drawn, and swaged to 0.304-in.-diam. rods. Several of the rods had an intermediate layer of a metal (Nb, Mo, Pd, or Pt) or of an alloy (U–Nb or U–Mo–Pt) between the fuel and the Zircaloy-2 cladding. Photomicrographs of the alloys and of the fuel rods before and after cold working are presented. (auth)

11718 WAPD-140
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
A COOPERATIVE STUDY OF THE ANALYSIS FOR IMPURITIES IN URANIUM METAL. N. E. Gordon, G. W. Goward, W. B. Haynes, and B. N. Nelson. Jan. 28, 1956. Decl. Mar. 12, 1957. 15p. Contract AT-11-1-GEN-14. $0.30(OTS).

Four analytical laboratories (Mallinckrodt, National Lead, New Brunswick, and Bettis) cooperated in a program to determine the precision and inter-laboratory agreement of analyses of U for impurities. A statistical study has been applied to the results for 9 of the elements determined. Comparisons at the 95% confidence level showed significant differences among determinations of Al, Si, and Mn. There were no significant differences in the determinations of Cr, Fe, B, Ni, Mg, and C. (auth)

11719 WAPD-A1W(FE)-291
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
EXTRUSION–PRELIMINARY EVALUATION. A. F. Steeves. Mar. 8, 1957. Contract [AT-11-1-GEN-14]. $1.80(ph OTS); $1.80(mf OTS).

Two 12 in. diameter, 1000 pound Zircaloy-2 ingots were extruded to 1½ in. × 7½ in bar stock on a 5500-ton Loewy press equipped with a 14 in. diameter container at a ram

speed of ~90 in./min. The only deleterious effect found was galling which occurred between the die and the Zircaloy-2 causing surface irregularities. The material of the quality produced in this experiment is quite usable. (W.L.H.)

11720 WAPD-FE-928

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

METAL FUEL ELEMENT DEVELOPMENT PROGRAM. Aug. 19, 1955. Decl. Mar. 5, 1957. 12p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

Work on the development of metal fuel elements is surveyed. In particular, the melting and cladding of U–Si fuel material are discussed. (B.J.H.)

11721 WAPD-FE-1105

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

THE FABRICATION OF ZIRCALOY-2 CLAD U–Mo AND U–Nb RODS FOR IRRADIATION IN THE MATERIALS TESTING REACTOR. W. B. Haynes. Oct. 31, 1955. Decl. Mar. 9, 1957. 51p. Contract AT-11-1-gen-14. $0.45(OTS).

Zircaloy-2 clad fuel rods whose fuel alloys were U–9 w/o Mo, U–10.5 w/o Mo, U–12 w/o Mo, 13.5 w/o Mo, and U–10 w/o Nb and rods each of whose fuel contained 5 w/o U^{235} and whose alloy content was U–9 w/o Mo, U–10.5 w/o Mo, U–12 w/o Mo, and U–13.5 w/o Mo were manufactured for testing in the Materials Testing Reactor. This report is issued to familiarize the interested parties with the procedures used in fabricating the material and the evaluation techniques utilized in determining its quality. The purposes of the in-pile testing were to determine the corrosion resistance and effects of irradiation on the U–10 w/o Nb alloy, the characteristics of the transformation caused by heat and irradiation of unclad U–10 w/o Nb samples in NaK filled capsules, the effects of long time burn-up of U–Mo fuel both clad and unclad, which had been extruded directly to size, and the effects of radiation on the U–Mo fuel alloys which had been heat treated to various metallographic structures prior to exposure. (auth)

11722 WAPD-MDM-25

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

MELTING URANIUM–3.8 w/o SILICON ALLOY. E. S. Foster. Jan. 25, 1955. Decl. Mar. 5, 1957. 6p. $1.80(ph OTS); $1.80(mf OTS).

Uranium–3.8 wt. % silicon alloy can be satisfactorily vacuum induction melted in Be crucibles with Th stopper rods and chill cast by bottom pouring into water cooled Cu molds. The induction melted castings can be remelted by the consumable arc process. (F.S.)

11723 WAPD-T-22

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

A SIMPLIFIED PROCEDURE FOR THE METALLOGRAPHY OF ZIRCONIUM AND HAFNIUM AND THEIR ALLOYS. F. M. Cain, Jr. Nov. 17, 1952. 23p. Contract AT-11-1-GEN-14. $14.80(ph OTS); $2.70(mf OTS).

The chemical polish-etch method is a five minute metallographic preparation of Zr and Hf and their alloys without the aid of mechanical or electrolytic polishing. Specimens to be prepared by this technique are abraded through a 3-0 emery or a #600 silicon carbide finish and subsequently dipped in, or swabbed with, the polishing solution. The resulting microscopic structures can be observed equally well under bright field or polarized light. A chemically polished specimen is also ideal for stain etching or heat tinting. Remote controlled metallography of irradiated specimens, non-destructive microscopic examination of large sections, macro preparation, bright pickling, and reducing dimensional thicknesses are other examples of the versatility of the chemical polish. (auth)

11724 WAPD-T-23

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

RECOVERY OF COLD WORKED ZIRCONIUM. W. A. Bostrom and S. A. Kulin. Nov. 15, 1952. 23p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

The annealing of cold worked crystal bar Zr was studied in the temperature range, room temperature to 575°C by electrical resistivity measurements at –196°C. Noticeable recovery occurred even at 100°C and recovery was quite rapid at the higher temperatures studied. No simple analytical expression could be found to describe the isothermal recovery process. The annealing kinetics of cold-worked Zr as determined by electrical resistivity changes parallel the results obtained by hardness measurements and X-ray diffraction studies. (auth)

11725 WAPD-T-167

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

CREEP PROPERTIES OF ANNEALED UNALLOYED ZIRCONIUM. M. J. Manjoine and W. L. Mudge, Jr. Dec. 10, 1953. Changed from OFFICIAL USE ONLY Apr. 2, 1954. 44p. $7.80(ph OTS); $3.30(mf OTS).

The creep properties of unalloyed Zr depend on the state of anneal. Up to 600°F (315°C) the plastic flow on loading is so much larger than the creep strain for 1000 hours that creep can be neglected in design for such service lives. Above 600°F creep plays an increasingly important role and must be taken into account. The strain of unalloyed Zr can be expressed as a function of stress, strain, and time as follows: $\epsilon = \epsilon_0 + \dot{\epsilon}t = Ae^{-B/T}\,\sigma^m + [C_1 e^{-C_2/T} \sinh \bar{\sigma}^2/C_3 T]t$ where ϵ is the strain, $\dot{\epsilon}$ is the strain rate, σ is the stress, $\bar{\sigma}$ is the stress at the intercept strain, T is the absolute temperature, t is the time, and the other quantities are constants. Therefore, the strain of unalloyed Zr follows the McVetty analysis, and the creep rate conforms to the hyperbolic sine law suggested by Nadai with the temperature dependent coefficient following the reaction rate theory as described by Kauzmann. The physical reasoning for the hyperbolic sine law and the influence of stress on the energy term of the reaction rate coefficient are discussed. (auth)

11726 WAPD-T-198

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

MELTING AND FABRICATION OF IODIDE HAFNIUM. J. G. Goodwin and W. J. Hurford. Feb. 1955. 40p. $6.30(ph OTS); $3.00(mf OTS).

This paper presents the current procedures for the melting and fabrication of iodide hafnium crystal bar. Two melting techniques, double arc-melting (non-consumable followed by consumable) and consumable arc-melting are discussed. Ingot conditioning by surface fusion is reported. Fabrication includes forging, hot and cold rolling of strip, rod and wire production, extrusion, machining and annealing. The metallography, hardness, chemical analysis and mechanical and physical properties of iodide hafnium are presented. (auth)

PHYSICS

11727 CF-56-2-110

Oak Ridge National Lab., Tenn.

COMPARISON OF VARIOUS THORIUM OXIDES. R. B. Gallaher and A. S. Kitzes. Feb. 6, 1956. Decl. Mar. 16,

1957. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS)

The effect of pumping on the properties of ThO_2 slurries was investigated. Properties evaluated include particle degradation, the thermal stability of crystallites, corrosive and abrasive effects on stainless steel, and general handling characteristics. (C.H.)

11728 KAPL-1468(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
PHYSICS SECTION REPORT FOR SEPTEMBER, OCTOBER, NOVEMBER 1955. Decl. with deletions Feb. 26, 1957. 15p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The Pu^{241} thermal eta experiment has been essentially completed. The subcadmium value of eta for Pu^{241} is 2.23. Eta values for U^{233} and Pu^{239} have also been obtained; they are 2.25 and 1.93, respectively. Construction of the new three-stage mass spectrometer is completed and preliminary experiments are in progress. Mass spectrometer analyses were made with the two-stage analyzer of all the rare earth elements and new improved upper limits have been assigned in most cases. A study of various methods of ion detection was initiated. A neutron energy spectrum in the center of the TTR has been determined to apply to the nuclear measurements of Pu isotopes. Results of the Monte Carlo studies of captures in the 6.7 ev U^{238} resonance in a HAPO lattice are reported. (auth)

11729 KAPL-M-HB-20
[Knolls Atomic Power Lab., Schenectady, N. Y.]
THE ESCAPE OF FISSION GASES FROM AN Na-FILLED CRACK BY DIFFUSION. Harvey Brooks. July 26, 1948. Decl. Mar. 29, 1957. 9p. Contract[W-31-109-eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The biggest hazard of the suddenly released gas is that it might block heat transfer locally. This would cause a rise in the local metal temperature which might in turn accelerate the release of other partially formed cracks. The danger will be especially marked if the gas is released into the Na film between the foil and the Be, and thus spreads out to form a large thermal block. It would appear that so long as the gas is released continuously, it can be carried away by diffusion without reaching concentrations in the Na at which gas bubbles are likely to nucleate. The chief hazard will arise from the sudden release of gas from cracks. The amount which can be released at one time is of the order of 10^{-3} cc and is sufficient to produce a small block in the heat transfer. (auth)

11730 LA-1273
Los Alamos Scientific Lab., N. Mex.
A NOTE ON THE CALCULATION OF NEUTRON MULTIPLICATION. Bengt Carlson. July 16, 1951. Decl. Feb. 23, 1957. 16p. W-7405-eng-36. $3.30(ph OTS); $2.40 (mf OTS).

The problems involved in calculating neutron multiplication are considered, and approximate formulae are given. (W.L.H.)

11731 WAPD-NCE-3308
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
BIBLIOGRAPHY OF U–MO FUEL ELEMENT PROGRAM. F. R. Lorenz. Jan. 31, 1957. 5p. $1.80(ph OTS); $1.80 (mf OTS).

INSTRUMENTS

11732 HW-30198(Del.)
General Electric Co. [Hanford Atomic Products Operation, Richland, Wash.]
REAR FACE MONITORING BY TELEVISION. Supplementary Report. W. J. Morris. Dec. 7, 1953. Decl. with deletions Feb. 19, 1957. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

ISOTOPE SEPARATION

11733 CN-2196
[Clinton Labs., Oak Ridge, Tenn.]
PREPARATION OF RADIOACTIVE BARIUM–LANTHANUM. Progress Report [for] April 15, 1944 to September 15, 1944. Problem Assignment No. 263-X60C. D. S. Webster. Nov. 14, 1944. Decl. Feb. 15, 1957. 26p. Contract W-7405-eng-39. $4.80(ph OTS); $2.70(mf OTS).

Procedures are described which were used in the preparation of several 140 curie batches of Ba^{140} to produce 100 curies of the hard γ-emitting La^{140} by the $PbSO_4$ precipitation process. Experiences involved in construction and operation of the engineering scale equipment are reported. Flowsheets and drawings of equipment are included. (C.H.)

MASS SPECTROGRAPHY

11734 A-2358
[Standard Oil Co. of Indiana, Chicago.]
EXCHANGE METHOD OF PREPARING BORON TRIFLUORIDE SAMPLES FOR MASS SPECTROMETER ANALYSIS OF DIMETHYL ETHER–BORON TRIFLUORIDE. C. M. Judson. Oct. 23, 1945. Decl. Mar. 12, 1957. 27p. Contract W-7418-eng-41. $4.80(ph OTS); $2.70(mf OTS).

A new procedure for the preparation of BF_3 samples for the mass spectrometer determination of B^{10} abundance in $(CH_3)_2O:BF_3$ is described. A measured amount of previously analysed BF_3 gas is brought to equilibrium with the $(CH_3)_2O:BF_3$ to be analysed. After equilibrium has been established, the gas is analysed and the abundance of B^{10} calculated. Using this method in conjunction with the null method of spectrometer analysis, accurate determinations can be made rapidly. Validity of the exchange procedure has been demonstrated by measurements of the rate at which equilibrium is approached and by an experimental verification of the calculated equilibrium constant for the exchange of boron isotopes between BF_3 gas and liquid $(CH_3)_2O:BF_3$. A comparison with the conversion procedure used heretofore in which $(CH_3)_2O:BF_3$ was converted into $CaF_2:BF_3$ and then into BF_3 gas indicates a slight but definite discrepancy between the two methods which has been attributed to errors in the CaF_2 procedure. In the course of the examination of the methods for preparing mass spectrometer samples, consideration has been given to the precision of the mass spectrometer measurements. (auth)

11735 K-374
Carbide and Carbon Chemicals Corp. K-25 [Plant], Oak Ridge, Tenn.
THE PRECISION OF TWO MASS SPECTROMETER METHODS. C. D. Tabor and L. A. Smith. July 1, 1949. Decl. Mar. 4, 1957. 12p. Contract [W-7405-eng-26]. (KLO-120). $3.30(ph OTS); $2.40(mf OTS).

The precision of relative mass spectrometer measurements of UF_6 has been significantly improved through a modification of the null procedure. The modification consists of taking partial null instead of complete null readings on the galvanometer scale. The tendency of operators to group repeated results is eliminated, and a more nearly normal distribution of the data is induced. (auth)

MATHEMATICS

11736 KAPL-M-JA-2
Knolls Atomic Power Lab., Schenectady, N. Y.
TOPSY, A 2-DIMENSIONAL MULTI-GROUP PROGRAM FOR THE UNIVAC. PART I. OUTPUT (MATERIALS SPECIFICATION). J. A. Archibald, Jr. July 27, 1956. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80 (mf OTS).

MEASURING INSTRUMENTS AND TECHNIQUES

11737 HW-29348(Del.)
General Electric Co. Hanford Atomic Product Operation, Richland, Wash.
A CONTINUOUS GAMMA ACTIVITY MONITOR FOR THE PRODUCT STREAM OF THE URANIUM RECOVERY PLANT. M. B. Leboeuf, R. E. Connally, and U. L. Upson. Oct. 1, 1953. Decl. with deletions Feb. 19, 1957. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A continuous γ-monitoring instrument capable of measuring the activity of the product of the uranium recovery plant has been developed and applied under process conditions. It has a detection limit of 15% and a normal range of up to 1000% of the activity of nautral U. Activity measurements made with this instrument have shown good correlation with laboratory determinations and are contributing to improved control of the solvent extraction process. (auth)

11738 K-662
Carbide and Carbon Chemicals Div. K-25 [Plant], Oak Ridge, Tenn.
SCINTILLATION TYPE COINCIDENCE CIRCUIT INSTRUMENT FOR LOW ENERGY GAMMA DETECTION. E. R. Rohrer. Aug. 25, 1950. Decl. Feb. 26, 1957. 8p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

The design of a portable scintillation γ-ray detector is described. The instrument features high sensitivity to U^{238} and a ten second response time attained through the use of a NaI(Tl) crystal and two photomultipliers in coincidence. (auth)

NUCLEAR PHYSICS

11739 ANL-4476
Argonne National Lab., Lemont, Ill.
PHYSICS DIVISION QUARTERLY REPORT FOR APRIL, MAY, AND JUNE 1950. A. Wattenberg, F. C. Hoyt, and Louis A. Turner, eds. July 5, 1950. Decl. Mar. 11, 1957. 115p. Contract W-31-109-eng-38. (deleted version: AECD-3846). $18.30(ph OTS); $6.00(mf OTS).

11740 ANL-4746
Argonne National Lab., Lemont, Ill.
PHYSICS DIVISION QUARTERLY REPORT FOR SEPTEMBER, OCTOBER AND NOVEMBER, 1951. Dec. 7, 1951. Decl. Apr. 4, 1957. 97p. Contract W-31-109-eng-38. $15.30(ph OTS); $5.40(mf OTS).

Fairly detailed report is made of experimental investigations of the following problems: the electron-neutron interaction; thermal-neutron capture cross section of H; diffusion constant of neutrons in D_2O; pile oscillator measurements (oscillator calibration, number of neutrons emitted per neutron absorbed in U^{235} and U^{233}, and capture cross sections of H, Hf, and Zr); time-of-flight measurements of neutron capture cross sections of separated isotopes of Hf; neutron transmission and scattering cross sections of B, Fe, Ni, and Bi; internal conversion of capture γ rays of Dy^{165}; preparation of scintillation detectors; cross sections of Cu^{63}, W^{186}, Co^{59}, and Ge^{74} for 35-kev neutrons; scintillation spectrometer studies of γ rays from Mn, Fe, Sc, Cr, Mo^{101}, Nd^{149}, Sm^{151}, Pm^{151}, and Nd^{151}; magnetic spectrograph studies of K/L ratios for internally converted γ rays; K/L ratios for Lu^{175} and Sc^{46m}; and gas-phase reactions of Br following activation by nuclear isomeric transition. The report of the Theoretical Physics Section includes discussions of the following topics; a two-model interpretation of a nuclear spectrum; the stochastic nature of spontaneous emission; and methods of solving the equation $\partial T/\partial t = \alpha\partial^2 T/\partial x^2 + Q(t,x)$ with given boundary conditions. (auth)

NUCLEAR REACTORS

11741 AMF-GR-10-55(Del.)
American Machine and Foundry Co. Greenwich Lab., Greenwich, Conn.
STUDY OF FUEL COST, CORE AND CONTROL PROBLEMS IN THE AMF CLOSED CYCLE BOILING REACTOR. F. S. Holzer and J. MacPhee. Sept. 14, 1955. Decl. with deletions Feb. 12, 1957. 59p. (ER-6872(Del.); G-4229 (Del.)). $9.30(ph OTS); $3.60(mf OTS).

11742 ANL-4554
Argonne National Lab., Lemont, Ill.
EXPERIMENTAL BREEDER REACTOR PROJECT. REPORT FOR THE PERIOD FEBRUARY 1, 1950, THROUGH MARCH 31, 1951. R. A. Cameron, B. C. Cerutti, L. J. Koch, H. V. Lichtenberger, D. F. McGinnis, M. Novick, E. N. Pettitt, H. E. Stanton, E. F. Stone, G. K. Whitham. Apr. 1, 1951. Decl. Jan. 17, 1957. 60p. Contract W-31-109-Eng-38. $9.30(ph OTS); $3.60(mf OTS).

The design of a pressure gauge system to show pressure changes in the fuel rods throughout the Experimental Breeder Reactor (CP-4) is described. Apparatus has been designed and built for filling the annulus in the lower section of the CP-4 fuel rod with NaK alloy. The procedure for adding NaK to fuel rods is described. Photographs are shown of the Reactor Inner Assembly and of its various parts. Safety and control rods and their drive mechanisms have been constructed and are shown. Operation of the safety plug is described. Velocity, acceleration, and time vs. distance curves of the plug fall are included. A detailed drawing is shown of a die for forming the external ribs on the CP-4 fuel rod jackets. The blanket bricks have been fabricated, autoclaved, and assembled on the lower shield section of the CP-4. The design of a totally enclosed liquid metal pump for the cooling circuit of the CP-4 is described in some detail. Results are given of a test of this pump in a NaK alloy coolant loop to determine its hydraulic characteristics. The design and operation of pressure transmitter unit for the reactor coolant system are described. Tests have been carried out to determine the heat transfer characteristics of a full size steam generator tube assembly under full power conditions. Design details and construction specifications of the tube are shown. Characteristics are shown of a gas circulating blower tested operating on air. (B.J.H.)

11743 ANL-5023
Argonne National Lab., Lemont, Ill.
EXPERIMENTAL BREEDER REACTOR PROGRESS REPORT FOR APRIL 1, 1951 THROUGH JANUARY 31, 1953. H. V. Lichtenberger, M. Novick, B. C. Cerutti, R. A. Cameron, D. F. McGinnis, E. N. Pettitt, G. K. Whitham, R. A. Haroldsen, and L. J. Koch. Feb. 20, 1953. Decl. Jan. 7, 1957. 46p. Contract W-31-109-eng-38. $0.45 (OTS).

The following EBR studies are reported: criticality studies; calibration of the control system; neutron flux measurements; fission-rate measurements; over-all temperature coefficient measurements; determination of the sign and magnitude of the metal temperature coefficient; measurement of power distribution in the core and in the internal and external blankets; over-all performance of the reactor cooling system; reactivity losses resulting from thermal expansion of slug elements; measurement of γ intensities around the reactor shielding; and disassembly of fuel rods. The shape of the flux for fission neutrons was determined by measuring the radioactivity of fuel rods at various positions along the rod and using rods from various reactor positions. U^{235}, normal U, and steel were evaluated when placed in the enriched fuel assembly of the reactor. (L.M.T.)

11744 ANL-5313
Argonne National Lab., Lemont, Ill.
QUARTERLY PROGRESS REPORT ON REACTOR DEVELOPMENT. (4000 PROGRAM). July 31, 1954. Decl. Mar. 29, 1957. 42p. Contract W-31-109-eng-38. $7.80 (ph OTS); $3.30(mf OTS).

Present plans for the Boiling Experimental Reactor (BER) are given. The reactor, auxiliaries, and power plant will be housed in a steel shell designed to maintain tightness against an internal pressure of 15 psig. The reactor pressure vessel is designed to operate at an internal pressure of up to 600 psig. Related experiments with Borax–I provided test information on a Cd fuse element for protection against rapid reactor transients. Such a power surge causes the heating of a U plug with melting of solder, releasing a Cd sleeve into the reactor. After completion of the fuse tests, a stronger control rod was inserted in the reactor and a short period excursion was initiated. The control rod was worth 4.1%k_{eff}. The resulting surge produced by rapid ejection of the control rod resulted in partial or total destruction of major reactor components. Instrumental data have not been fully analyzed from this incident, but a preliminary estimate of the nuclear energy released is in the region of 120 Mw-sec. The development of U alloys for fuel elements in the BER has been directed to the constitution, fabrication, corrosion, and heat treatment of Zr and Nb–Zr alloys. Fabrication techniques are being developed for Zircaloy–II–clad, natural-U plates. The design study of a small heat and power reactor for installation at remote locations presently calls for a boiling H_2O-moderated reactor operating at 5.5 Mw and a steam pressure of 600 psig. The reactor is located in a horizontal tank, using MTR-type U–Zr fuel plates. Current effort in the breeder reactor program is being directed to a working scale-model of the EBR-II. A general arrangement of the model is presented. Exponential studies on the neutron distributions within enriched assemblies containing U^{235}, U^{238}, Al, and Fe were carried out. A procedure for determining the U^{235}:U^{238} fission ratio was worked out using a 96% enriched and a natural-U miniature fission chamber. Results obtained from Li^6 speck-loaded nuclear emulsions exposed to monoergic neutrons from a Van de Graaff generator indicate that the energy resolution of this technique is about 200 kev at 270, 400, and 600 kev. Forthcoming experiments on the EBR-I Pu fuel charge will employ Pu–Al fuel alloy. Tentative values of hardness and coefficient of expansion were determined for this material. Preliminary values are reported on the variation of η of natural-U produced by irradiation in the NRX reactor. Further research is described on the recovery of U from U–Zr and U–Al alloys by fluoride volatility processes. Difficulties with reacting the bulk constituent with BrF_3 have been encountered, including U ignition under given conditions. A smooth and complete dissolution of U was affected by immersing the metal in HCl and bubbling Cl_2 through the solution. The reaction is catalyzed by 0.01 M $FeCl_3$ or 0.01 M HI. (K.S.)

11745 ANL-5371
Argonne National Lab., Lemont, Ill.
REACTOR ENGINEERING DIVISION QUARTERLY REPORT [FOR] OCTOBER 1, 1954 THROUGH DECEMBER 31, 1954. Jan. 15, 1955. Decl. Jan. 17, 1957. 284p. Contract W-31-109-eng-38. $1.60(OTS).

Physics. Two-group UNIVAC calculations were made for the BER in order to investigate the safety and operating characteristics of various core designs. Results indicate that considerable control over critical mass, power distribution, and to a lesser extent void and temperature coefficients, can be achieved by suitable arrangement of enriched- and natural-U fuel elements. Void coefficients can be made more negative by reducing the H_2O:U ratio. In all designs considered, the negative reactivity void coefficient of the cold reactor depends strongly on the increased leakage. Good results are obtained in calculating the reactivity held in steam for the operating boiling reactor with uniform fuel distribution, by assuming the steam to be uniformly distributed. Some reduction in reactivity held in the steam in a "flattened" reactor may be produced by reducing the steam voids in the outermost fuel elements. Other calculations are also reported for the EBR-II and the PBR on the following parameters: longterm changes, temperature coefficients of reactivity, control effectiveness, blanket power flattening, and power flattening by radial variation of enrichment. An iteration technique for calculating mutual interactions between steam voids and thermal neutron flux was studied for a uniformly loaded U^{235}, H_2O boiling reactor design. A control-rod analysis of various materials was undertaken to determine material thicknesses equivalent to a black Cd rod, and to establish burnup allowances for about 10-yr continuous operation. The materials studied were Cd, Hf, boral, B^{10}, B_4C, CaB_6, and ferro-boron. Burnup data were obtained for some of the Hf isotopes with appreciable neutron absorption cross sections. An extensive study of AVIDAC reactivity and kinetic calculations are presented. The use of diphenyl as a reactor coolant and moderator was studied at different power levels and moderator ratios, using stainless steel as a structural material. These reactor types were investigated for use with control-rod override of maximum Xe and burnup, and borated fuel elements and temperature override of maximum Xe. Temperature override was effective for maximum Xe in these reactors. Experimental work on bucklings, reflector savings, and U^{235}:U^{238} fission ratios in the Fast Exponential Experiment are being completed, and a final report on this project will appear as ANL-5379. A method for measuring the ratio of fission cross sections of two elements in a given flux was developed which is independent of the absolute sensitivity of the equipment. The following values were obtained in the center of the EBR: U^{238}/U^{235}–0.115, Th/U^{235}–0.0305, and Pu/U^{235}–1.42. Design of a very small fission counter for pile measurements is described. Heat Transfer. The expected steady-state nuclear heating of the BER pressure vessel was calculated, relating pressure vessel thickness, heat generation, temperature distribution, thermal stress, and pressure stress. Stresses in a carbon steel vessel without thermal shielding need not be excessive, but 304 and 347 stainless steel are not as desirable. Multi-channel natural circulation boiling density tests at 600 psia, and single-channel forced circulation tests at 260 psia are reported. The apparent thermal conductivity of steel shot in NaK eutectic was measured in an apparatus described in ANL-5134. The experiment is designed to simulate the

conductivity of U in liquid Na. Fuel Elements. An alternate fuel element design for EBR-II consists of a radiator-type element in which the coolant flows through channels in a stack of fuel wafers. An experimental procedure for electroplating U with Ni and Ag is given. Unclad high-U alloy samples (U-Si, U-Nb-Zr, and U-Nb) were corrosion tested in 500 and 550°F water. Additional corrosion testing of Ni-plated 2S Al was continued in 600°F water. Weight change data of thoria-urania bodies in 600°F water were obtained. A test facility is described for the irradiation of EBR-II pin-type fuel elements. A central thimble of the CP-5 reactor is used, and air cooling of the irradiated element is provided. One EBR-II pin-type fuel element (7 U pieces in a 304 stainless steel tube) was thermal cycled 200 times from 300 to 100°F in NaK. The U showed an average length gain of 2%. Structural Materials and Component Engineering Tests. A full-scale test section of a BER-type core was constructed, and air-cold water tests were made to determine the flow characteristics in the top reflector and downcomer. Water pressure-drop tests were made in a modified EBR-II pin-type subassembly. A reduction in pressure drop of 16 psi was effected by a new grid structure and fuel element orientation. A 4-in. Na loop with a d-c electromagnetic pump driven by a homopolar generator is described. The loop will be used to test thin-walled stainless or Nichrome tubing with fast-flowing Na up to 500°C. Certain changes in the control-rod layout of the BER are outlined. A test facility has been built to test the reference BER rod drive mechanism, which is also described. A number of alternate control rod drive mechanisms are evaluated. An apparatus is presented for developing Na-vapor rotary seals, and to test mechanical components, gears, bearings, and couplings immersed in Na vapor or liquid Na. Two newly-developed seal systems are discussed. Coolants. A dynamic corrosion loop was constructed to study the effect of circulating liquid Na (30 gpm) on irradiated and non-irradiated normal U. The content of Na_2O was studied as a function of time. Oxide content rose to a maximum, and dropped off. The maximum occurred sooner at higher operating temperatures. Two irradiated normal U pins were corrosion tested. Design and Evaluation. A detailed design study (No. 1) of the EBR-II is presented. The analysis includes reactor arrangement, shielding, fuel and blanket assembly designs, neutron and power distribution, Pu distribution, and a thermal analysis. (For preceding report in series see ANL-5345.) (K.S.)

11746 ANL-5471

Argonne National Lab., Lemont, Ill.

REACTOR ENGINEERING DIVISION QUARTERLY REPORT [FOR] APRIL 1, 1955 THROUGH JUNE 30, 1955. SECTION II. Sept. 1955. Decl. Jan. 17, 1957. 173p. Contract W-31-109-eng-38. $1.10(OTS).

Development of the thermal power reactor program is summarized. A complete conceptual design study is given for a nuclear power plant for 100-kw electric and 400-kw heat capacity. Calculations were made to evaluate the inherent safety of 20-Mw D_2O-cooled and moderated EBWR-type boiling reactors. The effects of rapid and slow, but large, increases in reactivity are summarized. Methods of calculating reactivity variation as a function of total energy production for enriched fuel, thermal reactors are discussed, and the methods were applied to two reactors. Results of the analysis are given in graphical form. Results of measuring fission cross section ratios in the EBR are also summarized. A brief account is given of neutron flux measurements using Np^{237} foils and of the foil preparation technique. Heat transfer tests include studies of the multichannel natural circulation boiling density at 600 psig, a discussion of the representation of average voids in boiling length with measurable parameters, normalized plots of void distribution along the boiling length, local boiling pressure drop in round and rectangular vertical channels, and burnout heat flux for wires in crossflow at atmospheric pressure. Fabrication and corrosion test history of EBWR fuel plates are tabulated. Zircaloy-2 specimens which had been heliarc spot welded are shown. The EBR-II core subassembly is shown. Designs are given for a Na-bond filling device for EBR-II pin-type fuel elements. Further attempts were made to produce a protective coating for uranium. The corrosion of high-U alloys in 500 and 550°F H_2O and the corrosion-irradiation of unclad high-U alloy pins are summarized. Water solubility tests on urania-thoria bodies were made. Corrosion data for nickel-plated 2S Al in 600°F H_2O are given, as are data on the dynamic H_2O corrosion of Al–Ni alloys. Static corrosion of anodized 2S Al in H_2O is also reported. Results of experiments of the fission product contamination of NaK bond in contact with U during irradiation are reported. The results of examination of the in-reactor tube tip from the Argonne Water Loop at the MTR are given. Water pressure drop tests of EBR-II core subassemblies were made. Heat capacity characteristics for the EBR-II working model electromagnetic pump are given. The primary EBR-II Na system is shown. Summaries of packing gland tests for liquid metal service are given. A study was made to estimate the rate of water decomposition in the EBWR. Corrosion inhibition studies have been continued. A dynamic cold trap liquid metal purification facility was installed in the EBR-II working model, and the initial results are reported. Schematics are given for the Na transfer system for the EBR-II working model. A manually operated electronic Na level probe is also shown. (For preceding period see ANL-5345.) (B.J.H.)

11747 ANL-5561

Argonne National Lab., Lemont, Ill.

REACTOR ENGINEERING DIVISION QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER, DECEMBER 1955. SECTION I. Apr. 1956. Decl. Jan. 17, 1957. 169p. Contract W-31-109-eng-38. $1.10(OTS).

Experimental Boiling Water Reactor. It was decided to use several types of fuel elements in order to achieve flexibility in the core loading. The structure of these fuel elements is tabulated. Using phenomenological methods, lattice constants, reactivities, and neutron economy of the reference EBWR were calculated, and results are tabulated. Neutron flux distributions in the core are shown. An analytical prediction was made of the natural circulation performance of EBWR at 600 psig. Calculations were also made to determine whether simple changes in the riser length and/or geometry would favorably affect EBWR performance. Complete results are given in graphical form. Design-economics analyses of EBWR fueling are summarized. The boiling water corrosion of Zircaloy-2 is shown. The EBWR control rod scram-time curve at 600 psig is shown. The thermocouples to be used for measurement of vessel temperatures are shown. The final designs for the pressure vessel shock springs are shown, and a load-deflection diagram is given. The gamma-ray flux and corresponding heat generation in the D_2O-moderated EBWR are listed. The status of EBWR construction is discussed. Data are included on the leakage-rate tests of the EBWR steel shell and on compression tests on specimen concrete shielding. Supporting and Alternate Design Research and Development. Boiling heat transfer studies were made. Riser studies indicate that riser height is not too important a parameter in influencing the ratio of velocities of steam and liquid. Data are given on the pressure drop resulting from 2-phase

flow. The transient behavior of the multi-channel natural circulation loop is discussed. Single-channel unrestricted and restricted natural circulation boiling studies are summarized in detail. Data showing the relationship between power density, voids, quality, recirculation flow, pressure, and geometry for boiling systems are given in both tabular and graphical form. Pressure drop measurements are included, and an analytical method of calculating natural circulation performance is outlined. The sources of error in steam void measurements are evaluated. A heating power source, which is to be used to determine experimentally the physical response of reactor components during a power excursion, is described. Corrosion tests on Zircaloy 2-clad U–Zr plates in 550°F degassed H_2O are summarized. Corrosion test data are also given for high-U alloys in 500°F H_2O. The high-temperature water corrosion of Al–Ni alloys is discussed. Corrosion-irradiation tests were also made on Al–Ni alloy plates. Progress is also reported on solution-irradiation and thermal cycling tests of urania–thoria bodies. A model of the rare earth oxide powder-filled control rod was thermal cycled and exposed to H_2O at 600 psig and 486°F in the EBWR control drive test facility. The mechanical properties of B-contained stainless steel alloys were listed. These alloys are being considered for use as the thermal shield for the EBWR pressure vessel. The corrosion characteristics of boron–stainless steel are also listed. Schematic diagrams are given for a hydraulically operated control rod drive and position indicator. A scram-time curve is given for the hydraulically operated control rod. Diagrams are also given for a magnetic jack control rod drive. Experimental Breeder Reactor–I. Danger coefficient experiments on EBR-I are summarized. Experimental procedures are outlined, and results are tabulated. Experimental Breeder Reactor–II. CP-5 irradiation tests on EBR-II pin type fuel elements are summarized, and photographs of the irradiated fuel elements are shown. An electrically heated model of an EBR-II fuel subassembly was constructed to determine the cooling requirements to remove the decay heat after irradiation. It was determined that a flow of 15 scfm of A gas at room temperature at a pressure of about 3 in. H_2O will maintain a maximum temperature below 1100°F. The activation of Na coolant by a fuel element with a hole in the end closure is discussed. A loop was constructed to test the release of such activity, and it was determined that in the EBR-II, 0.265 curies of activity would be released to the coolant Na every three months. The possible eutectic point formation of U with Fe in the stainless steel fuel tube was studied. Test conditions and results are listed. Diagrams are given of the EBR-II control rod mechanism. Calculated axial and radial γ and neutron fluxes in the EBR-II are shown. EBR-II Working Model. Design status is described. Supporting and Alternate Design Research and Development. Thermal cycling tests of Mo–U and Zr–U alloys are described. The development of electromagnetic pumps for the Na test loop is briefly discussed. (For preceding period see ANL-5511.) (B.J.H.)

11748 ANL-5571

Argonne National Lab., Lemont, Ill.

REACTOR ENGINEERING DIVISION QUARTERLY REPORT [FOR] JANUARY, FEBRUARY, MARCH 1956. SECTION I. July 1956. Decl. Mar. 28, 1957. 174p. Contract W-31-109-eng-38. $1.10(OTS).

Advanced Water Reactor Program. Flux distribution studies associated with the use of various combinations of natural and enriched U fuel plates in EBWR are reported. Fuel plate dimensional changes necessitated the calculation of revised thermal data. These new data are given along with the assumptions made in the calculations. The design of fuel assemblies, control rod channel closures, and the grid plate handling assembly are shown. Of the 9 EBWR control rods, 4 will be fabricated from a B-stainless steel system and 5 from Hf. The nuclear and economic considerations of such a rod arrangement are reviewed. The reactor shield and insulation is described and discussed. Reactor loading and unloading, fuel element storage, and the design and operation of the fuel transfer coffin and carriage are considered. A method of control rod removal without draining the pressure vessel is described. The status of fuel element corrosion tests and reactor component construction and fabrication is summarized. Boiling heat transfer studies associated with the EBWR were continued. Natural circulation boiling in single and multiple channels at 600 psig was investigated. Phase velocities, void effects, and friction factors are plotted. An analysis of the electrical characteristics of the power supplies used in these studies is also presented. A portion of the data gathered from Borax III operation is presented. Fission product activity buildup and decay in H_2O and steam, H_2O decomposition, and reactivity changes due to fission products and burnup were analyzed. Additional high-temperature H_2O corrosion data on U and Al alloys are reported for various pH values, H_2 concentrations, and flow velocities. Corrosion and irradiation data on ThO_2–UO_2 type fuel elements are also reported. Studies of the corrosion resistance, weldability, and machining properties of B-stainless steel systems were continued. Corrosion study results for other control materials and structural materials are reported. Fast Power Breeder Reactor Program. Two-dimensional calculations are reviewed which indicate minor changes in reactor component composition. The decay heat characteristics of EBR-II were determined, and a natural convection heat removal system was designed. The heat transfer characteristics of the bayonet cooler used in the system were investigated. In connection with the EBR-II shielding program, the fast neutron constants for Na and graphite were calculated. Results of thermal cycling tests on fission alloys are reported. Liquid metal heat transfer, fused fluoride corrosive effects, and liquid metal pump performance were also studied. (For preceding period see ANL-5561.) (D.E.B.)

11749 BMI-966

Battelle Memorial Inst., Columbus, Ohio.

NONDESTRUCTIVE INSPECTION OF PWR REFERENCE FUEL-ELEMENT CLOSURES. D. E. Stutz, J. H. Cahn, K. D. Cooley, and S. A. Wenk. Dec. 7, 1954. Decl. Mar. 1, 1957. 34p. Contract W-7405-eng-92. $0.35(OTS).

As a part of the development of an end closure for the PWR reference fuel element, the sensitivity of commercial nondestructive tests to flaws at the welded interface of the end cap and body was evaluated. Attention was also given to the improvement and adaptation of commercial tests for this specific application and the development of new methods of testing a welded interface of this type. The sensitivity of four types of commercial tests was investigated. Considering the factors that affect the sensitivity obtainable with radiography, it was calculated that a sensitivity of 4% could be obtained using a Co^{60} source and visual examination of the film. This agreed well with an experimental sensitivity of 3.2%. An 8-mil hole in a sample with a 0.250 core could be detected using a Co^{60} source. Conventional ultrasonic tests are relatively insensitive to flaws at the welded interface primarily because the interface itself gives a large ultrasonic reflection. The smallest flaw that could be detected by testing a fuel rod from the end with a 10-megacycle instrument was a hole that extended $\frac{1}{16}$ in. from the interface and was $\frac{1}{16}$ in. in diameter. The only

available eddy-current instrument (Multitest, frequencies of 2.5 and 20 Kc) was unable to detect any internal flaws at the interface. A number of samples were checked with fluorescent penetrants designed to detect voids or cracks open to the surface. No flaws of this type were present in any of the samples tested. (auth)

11750 BMI-1099
Battelle Memorial Inst., Columbus, Ohio.
THERMAL DISTORTION OF SAR HAFNIUM CONTROL ROD. William H. Goldthwaite, C. Malcolm Allen, and Sherwood L. Fawcett. June 27, 1956. Decl. Feb. 20, 1957. 17p. Contract W-7405-eng-92. $3.30(ph OTS); $2.40(mf OTS).

The thermal distortion of a Y-shaped Hf control rod heated by arrays of individually controlled radiation heaters was studied. The large axial and radial temperature gradients specified for this control rod were easily obtained with the radiation-heating method. The distortion, as measured with dial indicators, amounted to a 2-mil movement of the free end of the rod in the direction of the coolest blade. (auth)

11751 BMI-X-116(Del.)
Battelle Memorial Inst., Columbus, Ohio.
RADIATION SPECIMENS OF A FUEL ELEMENT. EXPERIMENTS PW-1-9, 1-10, and 1-11. G. D. Calkins, J. R. Keeler, and D. L. Keller. Feb. 26, 1954. Decl. with deletions Feb. 22, 1957. 16p. $3.30(ph OTS); $2.40(mf OTS).

The preparation and pre-irradiation testing of small radiation specimens of a fuel element are discussed, covering the 24 specimens for the ninth, tenth, and eleventh irradiations in stagnant water. (auth)

11752 BNL-223(Rev.)
Brookhaven National Lab., Upton, N. Y.
QUARTERLY PROGRESS REPORT FOR JULY 1–SEPTEMBER 30, 1952. Decl. Mar. 9, 1957. 25p. $4.80 (ph OTS); $2.70(mf OTS).

Progress on various projects of the Nuclear Engineering Department is summarized. Reactor Physics Division. Results of exponential experiments (buckling, migration area, intracell flux traverses, cadmium ratios) on H_2O–slightly enriched U rod lattices are presented. A search for a 2-hr Cr^{55} activity in slow-neutron-activated Cr was unsuccessful. Theoretical studies on CVR-type lattices and the Liquid Metal Fuel Reactor are mentioned. Applied Chemistry and Chemical Engineering Division. Progress is summarized on loop studies for the LMFR fused-salt fission-products extraction, BrF_3-UF_6 distillation, BrF_3 corrosive effects. in-pile processing of ThF_4 and related studies on Pa and U removal, sintering, and regeneration, and heat transfer in H_2O cross flow through the slightly enriched U lattice. Metallurgy Division. Experiments are in progress on the phase diagrams of the U–Bi, U–Pb–Bi, Th–Bi–Pb, U–Bi–Fe, U–Bi–Ni; few data being available. Static and dynamic corrosion tests on various stainless steels and Fe–Mo alloys in Bi, U–Bi, KCl–LiCl, and their mixtures are reported, and a liquid-metal convection pot for corrosion studies is sketched. Effects of pile radiation on self-diffusion in Fe, design of apparatus for in-pile creep experiments, thermal-cycling effects on BNL reactor fuel elements, and effects of shot-peening and cold-working on grain size of γ-U are described. (G.Y.)

11753 BNL-2849
Brookhaven National Lab., Upton, N. Y.
THERMAL UTILIZATIONS OF 0.600" DIAMETER, 1% URANIUM ROD LATTICES. H. Kouts, G. Price, V. Walsh. May 24, 1956. Decl. Feb. 12, 1957. 16p. $0.30 (OTS).

Early measurements of thermal utilization were repeated to obtain the correct values with 1% enriched 0.600" diameter rods in water lattices. Average fluxes in fuel, Al, and water, and thermal utilization values are tabulated. (F.S.)

11754 CF-51-10-94
Oak Ridge National Lab., Tenn.
CALCULATIONS OF LEAKAGE FROM THE BULK SHIELDING REACTOR. H. E. Hungerford and J. L. Meem. Oct. 5, 1951. Decl. Feb. 15, 1957. 14p. Contract [W-7405-eng-26]. $0.30(OTS).

Thermal neutron flux patterns throughout the water-reflected Bulk Shielding Reactor were determined for the north face. From these measurements calculations of neutron leakage from any face of the reactor may be made. (C.H.)

11755 CF-52-1-23
Oak Ridge National Lab., Tenn.
CRITICALITY REQUIREMENTS OF PROPOSED "TEAPOT." P[aul] R. Kasten. Jan. 3, 1952. Decl. Mar. 16, 1957. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Criticality calculations were completed for a $17\frac{1}{2}$" diam. water-moderated boiling type, stainless steel cylindrical reactor under a variety of operating conditions, and are summarized in graphical form. (M.H.R.)

11756 CF-52-9-175
Oak Ridge National Lab., Tenn.
INDUCED ACTIVITY IN THE BOILING REACTOR CORE TANK. A. R. Eckels. Sept. 26, 1952. Decl. Feb. 16, 1957. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The induced activity and unshielded biological dose rates at several distances from the center of the core vessels to be used for the boiling reactors are calculated. (B.J.H.)

11757 CF-53-4-292
Oak Ridge National Lab., Tenn.
USE OF COPPER AS AN INTERNAL RECOMBINATION CATALYST IN THE ISHR. P. N. Haubenreich and M. Tobias. Apr. 30, 1953. Decl. Feb. 14, 1957. 20p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The proposed use of copper as an internal recombination catalyst in the Intermediate Scale Homogeneous Reactor is discussed. The amount of copper required in the ISHR in order to keep operating pressures low enough so that an explosive mixture of hydrogen, oxygen, and water vapor cannot exist is calculated. The nuclear effects of copper addition in the ISHR were found by comparing the critical concentration and conversion ratio for the ISHR with and without copper. (J.E.D.)

11758 CF-53-10-24(Rev.)
Oak Ridge School of Reactor Technology, Tenn.
URANIUM PELLET POWER REACTOR. REACTOR DESIGN AND FEASIBILITY PROBLEM. H. W. Graves, Jr., J. P. Burelbach, R. J. Campana, H. W. Giesler, R. J. Gimera, R. Gulino, C. S. Sorkin, and P. W. Vineberg. Sept. 1, 1953. Decl. Mar. 18, 1957. 187p. $1.10(OTS).

The control and instrumentation arrangements of British Reactors are reviewed with particular reference to the development and modification of safety design resulting from experience with the various projects. Salient details (reactivity controlled, reactivity per control element, rates of reactivity addition, functional grouping of elements, modes of shut-down and safety line arrangements) are presented in tabular form, and each reactor is discussed briefly to demonstrate important, interesting or unusual features. (auth)

11759 CF-53-11-145
Oak Ridge National Lab., Tenn.
A PRELIMINARY INVESTIGATION OF POWER REMOVAL FROM A BOILING REACTOR. R. V. Bailey and P. C. Zmola. Nov. 1, 1953. Decl. Feb. 14, 1957. 73p. Contract [W-7405-eng-26]. $12.30(ph OTS); $4.50(mf OTS).

A preliminary investigation of three power removal mechanisms for boiling reactors is presented. The problem of relating core power density to mean weight density as a function of pressure is considered for processes involving surface evaporation, bubble growth and rise in a fluid with negligible internal circulation, and bubble growth and rise in a fluid with large internal circulation velocities compared with relative bubble velocity. Results of this analysis indicate that surface evaporation is a negligible factor in power removal except for small reactors. For larger reactors, 3 or 4 ft high, the predominant removal mechanism is natural bubble rise. It is further concluded that vapor entrainment in the circulating fluid limits removal for reactors with a free surface, in which circulation exists. (C.H.)

11760 CF-53-12-165
Oak Ridge National Lab., Tenn.
POISONING OF THE CORE OF THE TWO-REGION HOMOGENEOUS THERMAL BREEDER. Study No. 1. A. T. Gresky and E. D. Arnold. Dec. 11, 1953. Decl. Mar. 12, 1957. 30p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

An evaluation was made of the magnitude and nature of fission and corrosion product poisoning of the core solution in the Two-Region Homogeneous Thermal Breeder. A reasonable yield curve for U^{233} fissioning has been established from the available data. This curve was then utilized in determining the poison effects. There are nineteen isotopes, comprising a yield of 47%, that add considerable poison to the core system. Approximately 72% of the poison is contributed by isotopes of the rare earth group. Poison due to corrosion products also was appreciable. With one mil per year corrosion, these products are important when compared to the fission products. It thus can be seen that corrosion product removal would become as important as fission product removal if corrosion rates were as high as five mils per year. As accurate an analysis as is possible with the available data was made, and the results indicate the extent of reactor poisoning and the importance of core processing to remove these poisons. (auth)

11761 CF-54-3-44
Oak Ridge National Lab., Tenn.
ABRASION TEST OF THORIA PELLETS. I. Spiewak and J. A. Hafford. Mar. 9, 1954. Decl. Feb. 14, 1957. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Thoria pellets were tested for possible use as a blanket material for thermal breeder reactors. (F.S.)

11762 CF-54-3-160
Oak Ridge National Lab., Tenn.
CONSTANTS FOR HRT NUCLEAR CALCULATIONS. P. M. Wood. Mar. 30, 1954. Decl. Apr. 2, 1957. 10p. Contract [W-7405-eng-26]. $0.25(OTS).

11763 CF-54-6-40
Oak Ridge National Lab., Tenn.
THE RADIATION EXCURSION OF MAY 26, 1954. A Preliminary Report. Dixon Callihan. June 8, 1954. Decl. Mar. 14, 1957. 13p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

11764 CF-54-8-101
Oak Ridge National Lab., Tenn.
NEUTRON LEAKAGE SPECTRUM OF THE BULK SHIELDING REACTOR. James E. Faulkner. Aug. 16, 1954. Decl. Apr. 2, 1957. 12p. Contract [W-7405-eng-26]. $0.25(OTS).

Discrepancies between theoretical and experimental water dose curves for the Bulk Shielding Reactor were investigated. The calculated neutron distribution in an infinite homogeneous medium of reacting material of uniform power distribution was compared with a measured spectrum. The calculations are described, and the values are presented for 0, 1, and 2 collisions. (C.H.)

11765 CF-54-8-236(Del.)
Oak Ridge School of Reactor Technology, Tenn.
HOMOGENEOUS REACTOR FOR SHIP PROPULSION. Reactor Design and Feasibility Problem. P. R. Clark, W. O. Chatfield, A. E. Cox, J. M. Detwyler, J. A. Murphy, C. W. Nestor, R. R. Roof, and D. H. Walker. Aug. 1954. 140p. Decl. Feb. 15, 1957. 140p. $0.80(OTS).

Design of a 75-Mw homogeneous, circulating fuel reactor plant to meet the power, space and operating requirements of the C-4 Mariner class, cargo ship is presented. The fuel is fully enriched uranyl sulfate in heavy water and the operating conditions are 300°C and 2000 psi. Complete internal recombination, no fission product removal, and no mechanical control rods are specified in the design. Estimated weight, operating costs, and cargo capacity of the reactor powered ship are compared to those of the existing ship. The reactor powered ship is shown to be feasible and to be economically competitive with a conventional ship within the probable errors in the calculations, and it is concluded that expenditure of considerable effort on the design and development of such a reactor powered ship is justified. (auth)

11766 CF-55-1-113
Oak Ridge National Lab., Tenn.
SPECIFICATIONS ON STAINLESS STEEL STR IRRADIATION TEST ELEMENT. J. E. Cunningham. Jan. 21, 1956. Decl. Feb. 22, 1957. 20p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A program was planned for testing an experimental stainless steel fuel subassembly in the STR. The program was intended to aid in the development of a cheap, reliable plate-type fuel element for long-time service in the APPR, with possible applications to other reactors. Detailed descriptions of the fabrication and inspection procedures adopted for manufacturing the test element are given along with material and dimensional specifications. (D.E.B.)

11767 CF-55-5-112
Oak Ridge National Lab., Tenn.
APPR CRITICAL EXPERIMENT. J. G. Gallagher, R. R. Bate, J. E. Mann, and A. D. Callihan. May 18, 1955. Decl. May 9, 1957. 20p. Contract [W-7405-eng-26]. $10.80(ph OTS); $3.90(mf OTS).

A critical mockup of the Army Package Power Reactor is described. The purpose of the proposed reactor is to determine critical masses of clean and B-poisoned assemblies, to evaluate control rods, and to determine power and flux distributions. (W.L.H.)

11768 CF-55-8-191
Oak Ridge School of Reactor Technology, Tenn.
HIGH TEMPERATURE AQUEOUS HOMOGENEOUS REACTOR. Reactor Design and Feasibility Problem. A. Hauspurg, J. M. Finan, J. W. Geiser, B. H. Hamling, J. J. Happell, K. Moore, and G. R. Thomas. Aug. 1955. Decl. Feb. 15, 1957. 147p. $22.80(ph OTS); $7.20(mf OTS).

The feasibility of high temperature aqueous homogeneous reactors was investigated in this study. The physical requirements for a high temperature aqueous fuel were outlined. One system, operating with a reactor outlet temperature of 1200°F., was studied in detail, and its

costs were compared with those of a comparable low temperature system. (auth)

11769 CF-55-9-4
Oak Ridge National Lab., Tenn.
BREEDING RATIO AND CHEMICAL PROCESSING METHOD. Paul R. Kasten. Sept. 1, 1955. Decl. Feb. 16, 1957. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A preliminary report indicating the influence of processing method (continuous or batch) upon breeding ratio for one- and two-region reactors is presented. The results obtained for batch fuel reprocessing are compared with those for continuous fuel reprocessing, using the same average cycle time for each case. Two specific reactors were considered. For both the one- and two-region reactors the breeding ratio was higher (~.01–.03) if the fuel fluid was reprocessed by the batch process. (auth)

11770 CF-55-10-94(Del.)
Oak Ridge National Lab., Tenn.
A PRELIMINARY STUDY OF THE EFFECT OF LITHIUM SULFATE ON THE FUEL COST OF A PLUTONIUM PRODUCER-POWER REACTOR. H. C. Claiborne. Oct. 21, 1955. Decl. with deletions Feb. 19, 1957. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

It was found that the addition of Li_2SO_4 to $UO_2SO_4-D_2O$ solutions prevents phase separation, lowers the vapor pressure, and inhibits corrosion. Effects of the addition of Li_2SO_4 on thermal efficiencies and fuel cost of reactor fuels are discussed. (C.H.)

11771 CF-56-1-73
Oak Ridge National Lab., Tenn.
RECOMMENDATIONS TO HRT FROM HRT MOCKUP LOOP. H. L. Falkenberry and I. Spiewak. Jan. 18, 1956. Decl. Feb. 14, 1957. 9p. Contract [W-7405-eng-26]. $0.25(OTS).

The HRT mockup is not a true prototype reactor system, but an assembly containing several critical prototype components. Recommendation are presented for the operation of HRT auxiliaries including pumps (circulating, pulsa-feeder, and purge), high-pressure components (gas separators, heat exchangers, pressurizers, high pressure flanges, and let-down heat exchangers), valve controls, and instruments. (C.W.H.)

11772 CF-56-2-109
Oak Ridge National Lab., Tenn.
HRP-CP: DESIGN AND OPERATION OF FUEL ADDITION SYSTEM FOR THE HRT CHEMICAL PROCESSING PLANT. William L. Carter. Feb. 17, 1956. Decl. Mar. 16, 1957. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The initial fuel charge of the HRT will be added as a bulk amount at the beginning of hot operation; however, it is planned to supply make-up fuel as a D_2O concentrate in small weekly batches through the chemical plant fuel addition system. This system is designed so that fuel solution can be supplied through it without being contaminated by moisture in the atmosphere and so that accurate gravimetric measurements can be made of all ingredients. Normally fresh fuel will be admitted to the reactor core through the chemical plant high pressure system in conjunction with a regular chemical plant run; however, provisions have been made whereby fuel can be added directly to the fuel system dump tanks. The composition of fuel make-up to be added each week is given. (auth)

11773 CF-56-3-17
Oak Ridge National Lab., Tenn.
SURVEY OF GAS PRESSURIZATION FOR THE HRT. R. E. Aven. Mar. 30, 1956. Decl. Mar. 14, 1957. 55p. Contract [W-7405-eng-26]. $9.30(ph OTS); $3.60(mf OTS).

An introductory study of gas pressurization in the HRT was made. This type of pressurization will probably be used in the event that vapor pressurization proves unsatisfactory. Gas pressurization has several advantages: (1) The gas pressurizer may be maintained at any desired temperature. This eliminates problems associated with the high temperature required for the production of vapor at 2000 psia. (2) Reactor start-up operations proceed faster. Its disadvantages include: (1) Introduction into the system of a noncondensable gas. (2) Introduction and possible development of several new items of equipment to handle this gas. An estimate was made of the D_2 concentration in the gas phase of the reactor during a dumping operation for both the gas and vapor pressurized systems. This estimate indicates that the gas phase can become highly explosive (up to 20% D_2) during the dumping operation. If possible, a delay period (after power shutdown and before the dump begins) is recommended to allow time for some of the dissolved radiolytic gases to be recombined catalytically. (auth)

11774 CF-56-4-55
Oak Ridge National Lab., Tenn.
DESIGN CRITERIA—HRT PRESSURIZATION CONTROL. M. I. Lundin. Apr. 10, 1956. Decl. Mar. 16, 1957. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

11775 CF-56-4-170
Oak Ridge National Lab., Tenn.
PERMISSIBLE FUEL CONCENTRATION IN THE DUMP TANK OF THE HOMOGENEOUS RESEARCH REACTOR. D. R. Gilfillan and C. W. Nestor, Jr. Apr. 26, 1956. Decl. Mar. 14, 1957. 3p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Critical fuel concentrations at 20°C are given for long, cylindrical dump tanks having inside diameters of 20, 22, 24, 26, 28, and 30 in. (L.T.W.)

11776 CF-56-8-169
Oak Ridge National Lab., Tenn.
NEUTRON AND GAMMA FLUX PROBLEMS ASSOCIATED WITH THE CTD-HRP IN-PILE LOOP. E. D. Arnold. Aug. 27, 1956. Decl. Mar. 14, 1957. 21p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

An estimation of the thermal neutron flux distribution in the ORR in-pile loop indicates that the effective flux for a 4-in. spherical core would be 3.5×10^{13} n/cm^2/sec for the most probable loading of the ORR and 5.2×10^{13} n/cm^2/sec for the most optimistic loading (long side of loading on same side as experiment). The γ heat rate was also estimated and found to vary between 3.1 and 1.9 w/gr over the spherical core assuming that the front of the sphere is placed 2 in. from the lattice edge. The total γ heat for the spherical vessel would be 3500 w, with an additional 1200 w, or more, in the cooling coils necessary to remove this heat. The γ heat rate for the solution would be 2.5 w/gr or a total γ heat in solution of 1930 w. The expected Pu production rate would be ~ 6 mg Pu^{239}/d. (auth)

11777 CP-1747
[Chicago. Univ.] Metallurgical Lab.
A CASE OF ROD WARPING. F. Murray and G. Young. May 27, 1944. Decl. Feb. 15, 1957. 8p. (A-2457). $1.80(ph OTS); $1.80(mf OTS).

Warping of a rod by a variation in heat transfer coefficient around the periphery is considered. Estimates for some simple cases are given, and a more precise numerical calculation is carried out in one instance. (auth)

11778 HKF-1492D-41(Del.)
Ferguson, (H. K.) Co. Atomic Energy Div., New York.
PLUTONIUM PRODUCTION REACTOR. Progress Memorandum. Sept. 25, 1951. Del. with deletions Feb. 18, 1957. 13p. $3.30(ph OTS); $2.40(mf OTS).

Descriptive material and study data on a low-enrichment Pu production reactor are presented. General descriptions of the reactor, reactor vessel, reactor building, and control system are included. A process flowsheet for a reactor complex and estimated performance figures based on the flowsheet are discussed. The operating cycle is described. (D.E.B.)

11779 HW-13959
Hanford Works, Richland, Wash.
RATE OF BURNOUT OF ABSORBERS. P. R. Gillette. July 19, 1949. Decl. Feb. 25, 1957. 5p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Some rare earth elements contain a series of several isotopes of consecutive mass number, all of which are either stable or of such long half life and high thermal neutron absorption cross section that the probability of neutron absorption will, for obtainable fluxes, be much greater than the probability of radioactive decay. Under such conditions a chain reaction occurs in which lighter isotopes move up the series by successive n,γ reactions. The absorptivity of a material containing such an element will vary with time of irradiation in a complex manner, depending on the variation in cross section from isotope to isotope. Relations were derived which give the relative absorptivity, as a function of time, of series containing one or more isotopes with a given high cross section and one or more isotopes with another lower cross section, arranged in various orders. Results of calculations using these relations show that the absorptivity may exhibit a rapid decrease from its original value, a rapid increase to several times its original value followed by a slow decrease, or almost any kind of behavior between these two extremes, depending on the order in which high and low cross sections occur. Since the relations are exactly analogous to those for a radioactive decay chain similar conclusions can be drawn for chains in which long- and short-lived elements appear in various orders. (auth)

11780 HW-31837
General Electric Co. Hanford Atomic Products, Operation, Richland, Wash.
IMPORTANCE OF LONG IRRADIATION TIMES ON REACTOR ECONOMY. E. L. Armstrong. May 17, 1954. Decl. June 4, 1957. 13p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

To determine the effect of metal irradiation time on the cost to produce electric power. It is assumed here that it is necessary to convert from dual purpose operation of a 3000 Mw reactor plant to single purpose operation. Conclusions are drawn where possible. (auth)

11781 HW-37216(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
TREATMENT PROCEDURES FOR HIGH TEMPERATURE REACTOR COOLANTS. R. H. Purcell. Nov. 1, 1955. Decl. Apr. 1, 1957. 25p. Contract W-31-109-Eng-52. $0.35(OTS).

The water plant for a high-temperature reactor must be capable of providing several purities of water to the various components of the installation. The actual treatment methods will depend on the location and size of the reactor, size and sources of the water, and the ease of disposal of radioactive wastes. The requirements and use of service water are discussed and the inter-ties of the various intermediate treatment plants are reviewed. A brief summary of water requirements for the boiler feed system is presented. (auth)

11782 HW-42908
Hanford Atomic Products Operation, Richland, Wash.
PILE PERIODS AND THE INHOUR EQUATION ACCOUNTING FOR DELAYED NEUTRON GROUPS FROM FISSION OF U^{235} AND Pu^{239}. E. R. Astley. Apr. 27, 1956. Decl. Feb. 12, 1957. 54p. Contract W-31-109-Eng-52. $0.50 (OTS).

Calculations are presented regarding the effect of delayed neutrons in reactors fueled with mixtures of Pu^{239} and U^{235}. Results are plotted to illustrate the change in thermal flux as a function of time for various positive or negative step changes in reactivity. (auth)

11783 HW-43031
Hanford Atomic Products Operation, Richland, Wash.
ULTRASONICALLY BOND TESTING HANFORD FUEL ELEMENTS. D. C. Worlton. May 10, 1956. Decl. Apr. 1, 1957. 31p. Contract W-31-109-eng-52. $0.35(OTS).

Ultrasonic equipment was developed for nondestructive testing of Hanford fuel elements. The ultrasonic method has replaced the Frost Test for bonding layer inspection in the Hanford canning line, and provides more accurate and reliable results at lower cost. The method has also been adopted to the testing of new fuel elements for which no other method is available. (auth)

11784 KAPL-257
Knolls Atomic Power Lab., Schenectady, N. Y.
FEASIBILITY REPORT FOR THE ZERO POWER MOCK-UP OF THE DUAL PURPOSE REACTOR. H. Brooks, T. M. Snyder, and G. Dessauer. Sept. 30, 1949. Decl. Feb. 26, 1957. 8p. Contract W-3[1]-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Justification for additional fuel required for the engineering mock-up of a dual-purpose reactor is given. Specifications for and care of fuel disks are described. (F.S.)

11785 KAPL-267
Knolls Atomic Power Lab., Schenectady, N. Y.
REACTOR ENGINEERING, SECTION IV, PROGRESS REPORT NO. 39 [FOR] OCTOBER 1-31, 1949. Nov. 23, 1949. Decl. Mar. 30, 1957. 31p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS).

A review of the work on pile control, cooling, design, shielding, development tests, and process engineering is presented. (B.J.H.)

11786 KAPL-410
Knolls Atomic Power Lab., Schenectady, N. Y.
COOLING OF FAST BREEDER ROD (FBR-2). R. J. Fritz and R. G. Kennison. May 18, 1950. Decl. Mar. 29, 1957. 7p. (KAPL-M-RJF-4). $1.80(ph OTS); $1.80(mf OTS).

An analysis of the temperatures in the rod situated nearest the reactor core center is made. For the heat transfer picture, these rods consist essentially of a cylinder of natural U canned in stainless steel and forced cooled by Na flowing through an annulus formed between the matrix tube and the breeder rod. There is heat generation in the U due to neutron and γ flux from the reactor. The report considers also the problem of cooling this rod adequately so as to maintain temperatures in the U below 1020°F, the maximum allowable temperature at which the U dimensional stability is maintained. The analysis considers coolant by center hole plus annulus as well as annulus and no center hole. It is pointed out that a venturi section is advisable to restrict the flow under normal operating conditions, and yet present little flow resistance to the convective coolant currents under shutdown or emergency cooling conditions. It is shown that with future study the rod without the center hole may be feasible. It is further indicated that the design with the center hole does maintain safe temperatures. (auth)

11787 KAPL-541
[Knolls Atomic Power Lab., Schenectady, N. Y.]
THE METALLURGY SECTION; NUCLEAR ENGINEERING

COURSE, 1948 – 1949. J. P. Howe. (Lecture Notes by A. M. Anderson.) Mar. 24, 1949. Decl. Mar. 27, 1957. 7p. (Memo-NEC-16). $0.25(OTS).

The functions of metallurgy in reactor development are defined and broken into three phases of endeavor; metallurgical engineering, process studies, and research. (D.E.B.)

11788 KAPL-M-EDL-120
Knolls Atomic Power Lab., Schenectady, N. Y.
ROTATING PLUG ROTATING SEAL TEST. D. F. Wood. Aug. 23, 1956. 35p. Contract [W-31-109-Eng-52]. $6.30 (ph OTS); $3.00(mf OTS).

An investigation was conducted for the purpose of developing a seal, and determining the proper seal lubricant, to control the gas leakage from the S1G reactor during operation of the rotating plugs. It was determined that the requirements were most successfully filled by a diffusion-type seal consisting of two Garlock split Klozure solid seals. The flow of diffusion gas, i.e. seal leakage, was in the order of 0.001 standard cubic feet per hour of helium at 10 psig. Plastilube No. 1 proved the most satisfactory seal lubricant.

11789 KAPL-M-EDL-121
Knolls Atomic Power Lab., Schenectady, N. Y.
TESTS OF STATIC SEAL ADHESIVES FOR S1G/S2G ROTATING PLUGS. O. D. Terrell and M. L. Ballou. Aug. 22, 1956. 23p. Contract W-31-109-Eng-52. $4.80 (ph OTS); $2.70(mf OTS).

The properties of a number of commercial adhesives were investigated for the purpose of finding a suitable adhesive for the static seals of the rotating plugs. Samples of adhesives from approximately 30 manufacturers were tested for bond strength. The best results were obtained with Resiweld, a two-part epoxy resin which cures with equal strengths at temperatures between 70°F and 220°F. The maximum force required to separate the bonds obtained was 500 psi in tension.

11790 KAPL-M-HB-22
[Knolls Atomic Power Lab., Schenectady, N. Y.]
LEAKAGE FROM BLANKET. Harvey Brooks. Nov. 10, 1948. Decl. Mar. 29, 1957. 11p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The fraction of neutrons which escape from the blanket of the Schenectady Reactor is estimated by both a one-velocity and a two-group diffusion theory. (B.J.H.)

11791 KAPL-M-HB-27
Knolls Atomic Power Lab., Schenectady, N. Y.
SOME PRINCIPLES OF PIN FUEL DESIGN. H. Brooks. Aug. 22, 1949. Decl. Mar. 14, 1957. 14p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

In connection with pin fuel designs, calculations are made of pressure stresses arising from accumulation of fission gas and of thermal stresses arising from temperature differences across the wall of the fuel element. Optimum dimensions of the pin are given, and the surface-to-mass ratio for the pin is also calculated. (B.J.H.)

11792 KAPL-M-JRL-3
Knolls Atomic Power Lab., Schenectady, N. Y.
BURSTING OF FUEL PINS IN AN UNCONTROLLED REACTOR. J. R. Low, Jr. July 18, 1951. Decl. Mar. 8, 1957. 11p. Contract W-31-109-eng-52. $0.25(OTS).

The factors which may lead to rupture of a stainless steel fuel pin containing $MgO-UO_2$ when the power increases by a factor of e per millisecond are examined. It is concluded that the dominant source of internal pressure leading to rupture will be the vapor pressure of UO_2, and that rupture will occur in approximately 12 milliseconds under the conditions assumed. The pin wall can be expected to rupture at a great many separate points along its length, causing releases of the fuel mixture to the coolant, but not to shatter in the sense that a brittle material would. (auth)

11793 KAPL-M-JSB-1
Knolls Atomic Power Lab., Schenectady, N. Y.
REPORT ON DESIGN STATUS OF HOLD DOWN AND THERMOCOUPLE PLATE FOR 20½" INTERMEDIATE REACTOR. J. S. Blowney. May 20, 1949. Decl. Mar. 1, 1957. 42p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS).

Design and performance data are presented on a device to hold down the matrix and fuel slugs during pile separation. The hold down device also provides a reference surface against which safety rods may be positioned. Secondary purposes of the device include positioning thermocouples above the fuel slugs and to provide a neutron beam from the center of the reactor for use with a velocity selector. (C.H.)

11794 KAPL-M-LBV-7
Knolls Atomic Power Lab., Schenectady, N. Y.
REACTOR SAFETY FUSES. Leonard B. Vanderberg. Sept. 23, 1955. Decl. Mar. 11, 1957. 45p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS).

Reactor safety fuses are described and a literature survey presented. An experimental program for development of sensors for these fuses is outlined. (T.R.H.)

11795 KAPL-M-LRB-2
Knolls Atomic Power Lab. Schenectady, N. Y.
TEMPERATURE EFFECTS OF NUCLEATE BOILING. L. R. Boyd. Mar. 1, 1956. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The temperature behavior of a heating surface and the adjacent coolant water with varying degrees of nucleate boiling was investigated for the purpose of devising means of detecting the presence of nucleate boiling in the S3G. For the experiment, a small water channel, constructed of clear plastic, was used. A thin metal diaphragm formed one side of the channel. A portion of this diaphragm was heated electrically. Thermocouples were used to monitor the time average temperatures and the temperature fluctuations, both on the air side surface of the heated area of the metal diaphragm and in the water above and downstream from the heated area. The clear plastic construction permitted seeing the boiling on the heated surface. (auth)

11796 KAPL-M-RCD-14
Knolls Atomic Power Lab., Schenectady, N. Y.
APPLICATION OF BRAZE TO HEADER. Joseph Achtner. Nov. 18, 1953. 12p. Contract [W-31-109-Eng-52]. $3.30 (ph OTS); $2.40(mf OTS).

The fabrication of a prototype brazed poison tube header assembly for the control cylinder is discussed. (W.L.H.)

11797 KAPL-M-RE-8
Knolls Atomic Power Lab., Schenectady, N. Y.
FURTHER INVESTIGATIONS OF A FAST REACTOR. R. Ehrlich. Mar. 23, 1950. Decl. Jan. 17, 1957. 21p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

Two more multi-group calculations, fast reactors 4 and 5, were made. The largest change from the earlier calculations is to reduce the Na to U atomic ratio in the core from 6.4 to 1 to 3.5 to 1. The latter figure is in the neighborhood of the lower limit that the engineers felt they could attain with a pin type fuel structure. FR-4 uses the MgO reflector and FR-5 the Be reflector of the earlier calculations. In addition, the Ni structural material in the core is replaced by Fe and pin void is allowed for. Ni has an abnormally high scattering and hence slowing down cross section at lower energies. Since it is highly unlikely that Ni will be used in the core, its use gives an overestimate of the slowing down

to be expected from the structural material. Furthermore, the inelastic scattering is badly treated in fast reactors 1 through 4. That of the structural material was neglected, and that of the fuel in the core was taken too big. The two tend to cancel out to a large extent. The inelastic scattering in the blanket U was taken from LA-140. These values are probably too high. In FR-5 we attempted to treat these cross sections more reasonably and added a further high energy group from 10 to 3.68 Mev (u = 0 to u = 1). A fission source was assumed in the natural U blanket for FR-5 to get a better idea of the properties of such a blanket. As in the earlier calculations, no allowance was made for burnup, fission product poisoning, or thermal expansion. (auth)

11798 KLX-1609

Vitro Corp. of America, New York.

HOMOGENEOUS REACTOR PROCESSING PROGRESS REPORT [FOR] PERIOD JANUARY 1–31, 1953. Job 57. Feb. 10, 1953. Decl. Mar. 22, 1957. 37p. Contract AT (11-1)-217. $7.80(ph OTS); $3.30(mf OTS).

The development of the most economical method for recovery D_2O solvent from spent homogeneous reactor UO_2SO_4 fuel solution and the principle basic requirements for such a method are presented. The decontamination of spent fuel solutions by use of ion exchange resins and non-resinous solid absorbents to remove Neutron-absorbing fission products, and the recovery of U from the adsorbents to permit an economic comparison of ion-exchange with solvent extraction and other processes are studied. (W.L.H.)

11799 KS-215(Del.)

Carbide and Carbon Chemicals Co. [K-25 Plant, Oak Ridge, Tenn.]

GRAPHICAL SOLUTION OF THE EQUATIONS FOR THE WATER-TAMPED WATER BOILER. R. Gwin and H. F. Henry. July 25, 1951. Decl. with deletions Feb. 28, 1957. 21p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

Graphical solutions of the critical relation as derived by Greuling for water-moderated and water-tamped systems of U^{235} are presented and are compared with available experimental data and extrapolations of those data. Such comparison is possible only for material of high U^{235} assay. However, some theoretical low-assay results are also presented. (auth)

11800 MIT-5000

Massachusetts Inst. of Tech., Cambridge. Nuclear Engineering Project.

NUCLEAR PROBLEMS OF NON-AQUEOUS FLUID-FUEL REACTORS. Clark Goodman, John L. Greenstadt, Robert M. Kiehn, Abraham Klein, Mark M. Mills, and Nunzio Tralli. Oct. 15, 1952. Decl. Feb. 28, 1957. 266p. Contract AT(30-1)-1359. $1.60(OTS).

Considerations which led to the choice of two reactors for detailed study are first outlined. These were (1) a fast converter using as fuel a solution of UCl_4 in fused chlorides, and (2) a thermal converter using as a fuel a liquid alloy of U in Bi. Extensive discussion is presented on nuclear constants, calculation methods and results, poisoning, and control methods for the fast reactor. Studies for the thermal reactor included calculations on bare homogeneous reactors, heterogeneous reactors, final design, and poisoning. A separate chapter compares the two reactors. Appendices contain details of calculation methods, and the results of nuclear studies not directly related to the reactor processes given engineering study. (L.M.T.)

11801 ORNL-990

Oak Ridge National Lab., Tenn.

HOMOGENEOUS REACTOR EXPERIMENT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING FEBRUARY 28, 1951. W. E. Thompson, comp. May 18, 1951. Decl. Mar. 1, 1957. 147p. Contract W-7405-eng-26. $24.30 (ph OTS); $7.50(mf OTS).

HRE Reactor Physics and Engineering. Progress is reported on HRE process flow, soup-recirculating test loops for the HRE, core-gas-removal systems, flow patterns in the HRE core, HRE control and simulator instrumentation systems, and building construction. Corrosion and Radiation Stability. Progress is reported on film corrosion studies on pretreated stainless steel, the corrosion resistance of stainless steels, Zr, and reflector materials, UO_2F_2 corrosion studies, and $UO_2(NO_3)_2$ corrosion studies. Analytical data for previous experiments are also summarized. Progress is also reported on the effect of low-temperature irradiation on corrosion studies, and peroxide precipitation studies. Recombination of Hydrogen and Oxygen. Laboratory- and pilot-scale studies are summarized. HRE Chemical Studies. Progress is reported on the solubility of fission product sulfates, $BaSO_4$ precipitation and Xe concentration in the HRE, and analytical chemical control. Experimental Program for the HRE. Subcritical, low-flux, and high-flux experiments are described. Long-range experimental studies are also discussed. (M.H.R.)

11802 ORNL-1904

Oak Ridge National Lab., Tenn.

AQUEOUS URANIUM SLURRY STUDIES. J. O. Blomeke. Oct. 20, 1955. Decl. Jan. 17, 1957. 65p. Contract W-7405-eng-26. $10.80(ph OTS); $3.90(mf OTS).

The possible use of aqueous uranium oxide slurries as reactor fuels has been investigated. It was found that U^{6+} was the most stable valence state in such slurry fuels. Several methods for the preparation of $U_2O \cdot H_2O$ are described. The crystal structure of $UO_3 \cdot H_2O$ was examined. Slurries of $UO_3 \cdot H_2O$ were tested for thermal stability, radiation stability, and corrosive properties. (C.W.H.)

11803 ORNL-2042

Oak Ridge National Lab., Tenn.

HRP RADIATION CORROSION STUDIES: IN-PILE LOOP L-4-8. J. E. Baker, N. C. Bradley, G. H. Jenks, A. R. Olsen, H. C. Savage, and F. J. Walter. Aug. 21, 1956. Decl. Jan. 17, 1957. 35p. Contract W-7405-eng-26. $0.40(OTS).

A fifth in-pile loop experiment, L-4-8, was completed. The loop operated in-pile for a total of 1637 hr, during which time the LITR energy output was 4377 Mwhr. The average fission power in the loop based on Cs analyses was 622 w when the LITR was at full power (3 Mw). Based on O_2 data, the generalized corrosion rate for the first 300 hr was 4.0 mpy; the rate for the remaining 1337 hr was 0.7 mpy. The Ni data gave parallel results. The corrosion of the type 347 stainless steel, Zircaloy-2, and Ti-55AX coupons exposed in the core and in in-line holders was generally consistent with that observed in previous in-pile loop experiments. Some differences with steel were attributed to the fact that this was the first loop containing steel specimens operated with 0.04m H_2SO_4 present in the UO_2SO_4 charge solution (0.17m UO_2SO_4, 0.03m $CuSO_4$). Stress specimens, made from the alloys Zircaloy-2, type 17-4 PH stainless steel, and Ti-C-130-AM, were exposed in core, in-line, and pressurizer locations. Microscopic examination and average weight loss gave no indication of effects attributable to the stressed condition of the specimens. (auth)

11804 TID-5341

Westinghouse Electric Corp., [Pittsburgh].

CLEANING AND PICKLING OF CORE COMPONENTS, QUALITY CONTROL COUPONS, SUBASSEMBLIES, AND BUNDLES. W. J. Hurford. Feb. 22, 1956. Revised May

15, 1956. Decl. Mar. 12, 1957. 7p. (PS-AP-292489). $0.25(OTS).

Safety requirements are set forth for the cleaning of materials that entail the use of corrosive and inflammable materials and exposure to radioactive materials. The procedure for the cleaning operation and the handling of cleaned parts such as storage, solvent cleaning and wiping, mechanical cleaning, water rinsing, pickling, drying, and grit and vapor blasting are presented. (W.L.H.)

11805 TID-5371

Du Pont de Nemours (E. I.) & Co. Savannah River [Lab.], Augusta, Ga.

FILLING R AREA STORAGE TANK WITH HEAVY WATER. C. L. Howard and E. C. Bertsche. June 1, 1954. Decl. Mar. 7, 1957. 11p. Contract [AT(07-2)-1]. (DPSP-54-25-18). $3.30(ph OTS); $2.40(mf OTS).

Following functional tests and the light water dummy run of Savannah River Reactors moderator the light water was drained and the equipment dried by blowing with air, vacuum drying, or helium drying. Critical parts of the system were rinsed with minimum amounts of heavy water to insure the absence of significant amounts of light water and the entire system was then filled with moderator. Procedures used for draining, drying, and charging are evaluated. Recommendations for improvements in the procedures are included. (C.H.)

11806 TID-10027

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PRESSURIZED WATER REACTOR PROGRAM TECHNICAL PROGRESS REPORT FOR THE PERIOD AUGUST 26, 1954 TO OCTOBER 7, 1954. Decl. Mar. 14, 1957. 80p. Contract AT-11-1-GEN-14. $0.50(OTS).

Bearing tests using Graphiter 14 against a Stellite Star-J runner were conducted. Thrust loads up to 100 psi were imposed. Analog computer flux plots and power density distributions were analyzed for several "annular seed" cores with natural UO_2 blankets. Results for a 6 ft × 6 ft cylindrical core indicate that such an arrangement permits operation at reasonable power densities. Thermal and hydraulic studies show that for a H_2O-to-U ratio of 2.5, a decrease in UO_2 packing density would decrease the center-to-center distance between 0.6-in. fuel rods by 3%, decrease the coolant flow and pressure drop, and increase the Zr required. Fabrication techniques for U–Mo fuel elements are being developed, with current emphasis on the co-extrusion of Zircaloy-clad specimens. Autoclave tests on the resistance butt welding method of end closing, for a period of 14 days in 650°F water were successful. A scheme for joining the fuel rods into a fuel bundle was conceived by fitting notched wires through holes in the fuel rod end plug. Test data on the corrosion life of Zircaloy-clad Mo–U alloys in water near 350°C are presented. The activation energy for diffusion between U-12 wt. % Mo and Zircaloy-2 was measured as a function of time at 700°C. Additional corrosion results with carbon steel are also discussed. New results were obtained on the effects of boric acid control solutions on a variety of reactor materials. Samples of clad U–Mo alloys were irradiated in the MTR and only slight dimensional changes were noted. Other samples of irradiated natural UO_2 showed no signs of dimensional instability, fission gas, corrosion, or fragmentation. One-dimensional studies on the seed core design indicate that 60% of the power of an annular core may be obtained from the natural-U blanket. Critical and temperature coefficient measurements were begun with 1.15% enriched fuel. Attenuation characteristics of ordinary concrete for primary water radiations were determined. (D.E.B.)

11807 TID-10097

Dow Chemical-Detroit Edison and Associates. Atomic Power Development Project, Detroit.

INFORMATION REPORT ON THE PROJECT ACTIVITIES FOR THE PERIOD DECEMBER 1, 1953 TO JULY 31, 1954. Sept. 1, 1954. Decl. Jan. 7, 1957. 78p. $0.55(OTS).

The organization and current budget of the Atomic Power Development Project are briefly summarized. Fuel element design and fabrication studies are reported. General corrosion tests are being conducted on a variety of materials for use in liquid metal systems. Globeiron and Zr show promise as reactor core cladding materials. An evaluation of various mechanical components of liquid metal and steam power systems is being carried out. Studies of reactor control methods have been emphasized. The most promising concept appears to be a control system in which a fast neutron reflector (iron) is exchanged for a fast neutron poison (Li^6) in the reflector region. Temperature coefficients of reactivity have been calculated for the reference design reactor. A conceptual design of the mechanical handling system for fuel and blanket elements in the reference design is shown. Aqueous and nonaqueous methods of fuel processing are being studied and evaluated. Studies of reactor economics, safety, and alternate reactor designs are reported. (M.P.G.)

11808 TID-10138

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PRESSURIZED WATER REACTOR PROGRAM TECHNICAL PROGRESS REPORT FOR THE PERIOD DECEMBER 30, 1954 TO FEBRUARY 10, 1955. Decl. Mar. 18, 1957. 111p. Contract AT-11-1-gen 14. $0.70(OTS).

A detailed set of PWR plant parameters is given. Transient calculations reported previously have been extended to an evaluation of pressure and temperature transients resulting from a pipe break in the primary coolant loop. Preliminary design drawings are presented for the annular seed type of reactor core using a U–12% Mo blanket. Studies of optimum dimensions and computations for this design were initiated. The annular seed core consists of seed and natural U subassemblies of square cross section. The seed elements will be located in an annular geometry, half-way between the center axis and outside edge of the core. The seed region will be one assembly thick, and will be arranged in the form of a hollow square. Each seed assembly will have one control rod, and will consist of enriched flat fuel plates. The natural assemblies will be fuel rod bundles of U–Mo alloys. Several new techniques have been developed for the fabrication of fuel rods. It was found that difficulties with the drawing of Zircaloy tubing were due to H_2 contamination from the annealing atmosphere. Data were obtained on the oxidation of U to UO_2 by steam. Corrosion studies previously reported on U–Mo, U–Mo–Pt, U–Mo–Nb, U–Zr–Nb, and Zr-clad U alloys are continued. The addition of Ni and Pt ions to the corrosion test water was found to appreciably inhibit H pickup by γ-phase alloys. The addition of Pt and Nb to U–Mo alloys considerably extended corrosion test life. Tests are continuing in an effort to find a substitute brazing alloy for microbraze. Successful decontamination of the Chalk River R-1 loop was achieved by circulation of water at operating temperature with alternate additions of O_2 and H_2 in combination with thermal cycling. In the WAPD R-1 loop after failure of a U–Mo specimen however, treatment with citric acid was necessary. Additional radiation effects tests were conducted on U–Mo and UO_2 fuel specimens. One-dimensional UNIVAC calculations have been made for the annular seed core. Criticality results were obtained from the PWR Flexible Critical Facility. (K.S.)

11809 UCRL-961
California. Univ., Berkeley. Radiation Lab.
MULTIPLYING LATTICES. H. Brown. Oct. 18, 1950. Decl. Mar. 5, 1957. 7p. Contract [W-7405-eng-48]. $1.80(ph OTS); $1.80(mf OTS).

One- and two-group approximations are made of neutron fluxes in a lattice using thermally fissionable material, and resulting flux distributions are shown in graphical form. (B.J.H.)

11810 WAPD-PWR-FE-1122
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
STATUS AND RECOMMENDATIONS FOR PWR SEED DEVELOPMENT PROGRAM. (Ref: WAPD-FE-1078). F. R. Lorenz. Nov. 18, 1955. Decl. Mar. 5, 1957. 5p. $0.25(OTS).

It is recommended that Hf, instead of boron–stainless steel, should be used as the control rods in the PWR core. Recommendations concerning the use of resistance welded subassemblies for the seed are also briefly discussed. (B.J.H.)

11811 WAPD-PWR-PMF-625
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
LITHIUM RESINS FOR pH CONTROL. Purchasing Department Specification 12285-E. [Feb. 6, 1957]. 6p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

It was proposed for the PWR that $LiOH \cdot H_2O$ be used to maintain the pH of the reactor coolant between a range of 9.5 to 10.5 automatically controlled by use of LiOH resin in the coolant Purification system. Specifications are given for resins for pH control and removal of dissolved impurities from water. (W.L.H.)

11812 WAPD-PWR-PMM-1034
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
FISSION GAS PRESSURES WITHIN PWR CORE 1 FUEL RODS AND PROPOSED PWR CORE 2 FUEL ELEMENTS. Jan. 21, 1957. 11p. $3.30(ph OTS); $2.40(mf OTS).

Estimates of the pressures developed at high burnups in the PWR Core 1 fuel rod and the 6-ft long tubular elements and compartmented plates containing oxide plates 0.04 in. and 0.08 in. thick are given. (W.L.H.)

11813 WAPD-T-323
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE ROD-OSCILLATOR METHOD FOR CALIBRATING CONTROL RODS. F. J. Jankowski, D. Klein, and T. M. Miller. Mar. 1956. 25p. $4.80(ph OTS); $2.70(mf OTS).

A method is reported for calibrating control rods by oscillating techniques. A theoretical treatment is given and experimental results obtained by this method are compared with those obtained by the rod bump-period method. A relative calibration is also described. (auth)

11814 WAPD-T-388
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SIMULATION OF HOT CHANNEL BOILING IN WATER COOLED REACTORS. S. O. Johnson, N. J. Curlee, J. V. Reihing. Feb. 1957. 67p. Contract AT-11-1-GEN-14. $10.80(ph OTS); $3.90(mf OTS).

The problems encountered in a study of the transient response of a heat transfer system in which the coolant experiences a phase change are discussed. A mathematical model of the system is developed and the partial differential equations governing the transient response are derived. The equations are then transformed to differential-difference equations suitable for solution on an electronic analog computer. The analog computer circuit is developed from the equations and the peculiarities of the circuit are described in detail. Analog results of a typical coolant flow transient are presented. (auth)

11815 WAPD-T-389
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
DIRECTIONAL PROPERTY OF MAGNETIC SATURATION UTILIZED IN DESIGN OF POSITION INDICATOR. P. S. Nissenson. June 1956. 13p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

An extraneous d-c magnetic field had an undesirable effect upon the performance of a position-sensing element of the variable inductance type. The paper describes how the directional property of magnetic saturation was utilized in the design of a sensing element that is not affected by the extraneous magnetic field. (auth)

PARTICLE ACCELERATORS

11816 LWS-12008
California. Univ., Berkeley. Radiation Lab. and California Research and Development Co., Livermore, Calif.
J-16 CYCLOTRON RESEARCH REPORT. Sept. 1951. Decl. Feb. 28, 1957. 54p. $9.30(ph OTS); $3.60(mf OTS).

A clover-leaf type cyclotron which is proposed for construction is described. Data on the costs of construction and operation of production cyclotrons are included. (W.L.H.)

11817 LWS-24477
California Research and Development Co., Livermore, Calif.
METHOD FOR EVALUATING THE PRESSURE AND TEMPERATURE CHARACTERISTICS OF GAS COOLED TARGETS. J. E. Mahlmeister and M. F. Katzer. July 28, 1952. Decl. Feb. 26, 1957. 19p. (CRD-T2B-128). $3.30 (ph OTS); $2.40(mf OTS).

Problems encountered in the MTA program involve the gas cooling of target elements. This makes it necessary to evaluate the fluid flow and heat transfer properties of a gas flowing at subsonic velocities through ducts. The following analysis has reviewed the literature and presents a method for evaluating the properties under conditions of variable heat flux from the walls of the duct. The analysis also permits the flow passage to have a variable area. This study shows that under these conditions it is necessary to consider the compressibility effects of the gas. It also shows that the effect of an increase in flow area tends to counteract the heating effects on the Mach number. (auth)

RADIATION EFFECTS

11818 BMI-X-130(Del.)
Battelle Memorial Inst., Columbus, Ohio.
STATUS OF AN ALTERNATE CONTROL MATERIALS PROGRAM. S. J. Paprocki. Aug. 15, 1956. Decl. with deletions Feb. 13, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

Programs to determine the resistance of various B compounds to reactor radiations and the radiation stability of B and B-compound dispersions in Ti and Zircaloy are briefly outlined. (D.E.B.)

11819 LWS-30103
California Research and Development Co., Livermore, Calif.
DEUTERON AND NEUTRON INDUCED ACTIVITIES IN NaK COOLANTS. S. J. Horn. Feb. 18, 1954. Decl. Feb. 26, 1957. 26p. (CRD-R-107). $4.80(ph OTS); $2.70(mf OTS).

In an MTA type target which is bombarded with 500 Mev deuterons, the NaK coolant will become radioactive after short periods of operation. The total activity induced in the coolant by the 500 Mev deuterons, and neutrons arising from the deuteron interactions, will establish the shielding requirements for the coolant circuit. This report presents a general method for estimating this total induced activity. (auth)

11820 NAA-SR-76

North American Aviation, Inc., Downey, Calif.

CHANGES IN THE HALL AND MAGNETO-RESISTIVITY COEFFICIENTS DURING PULSE-ANNEALING OF IRRADIATED GRAPHITE. W. P. Eatherly. Sept. 25, 1951. Decl. Feb. 26, 1957. 17p. Contract AT-11-1-GEN-8. $0.30(OTS).

Pulse-annealing studies are presented of the Hall and magneto-resistivity coefficients for samples irradiated from 1.5 to 1534 mwd/ct. The annealing range covered is room temperature to 2300°C. The two types of graphite studied, AGOT-KC and EBP, show no differences other than those to be expected from orientation and density variations. Full recovery to preexposure values is obtained with the exception of one sample. A decomposition into annealing states is sharp only for short exposures; at exposures of 48 mwd/ct or more a great deal of overlapping of regions is obtained. In general, however, the curves are similar to what might be expected from theory and the previously measured resistivity annealing curves. (auth)

SHIELDING

11821 BNL-1443

Brookhaven National Lab., Upton, N. Y.

NEUTRON STREAMING THROUGH BOUNDARIES IN A MOCK-UP OF THE SIR ROTATING PLUG. Herbert J. C. Kouts, William W. Pratt, Robert D. Schamberger, Ferdinand J. Shore, Harvey P. Sleeper, Jr., and Herbert Susskind. Mar. 25, 1953. Decl. Feb. 21, 1957. 69p. $10.80(ph OTS); $3.90(mf OTS).

Neutron-attenuation data obtained at the Brookhaven shielding facility on a mock-up of the fuel-rod-unloading plug used in the SIR are summarized. The thermal neutron flux, fast neutron dose, and γ-ray dose were measured in the water behind various components of the mock-up. Details of the experimental mock-up, radiation detectors, calibration of instruments, and compilation of test data are appended. (L.T.W.)

11822 BNL-2796

Brookhaven National Lab., Upton, N. Y.

CALIBRATION OF THE BROOKHAVEN SHIELDING STUDIES FISSION SOURCE. Herbert Kouts and William Pratt. Nov. 29, 1951. Decl. Feb. 13, 1957. 15p. $3.30 (ph OTS); $2.40(mf OTS).

Power generation in the Brookhaven fission source was measured by evaluating the heat added to coolant air. This determination allows direct comparison with Oak Ridge neutron sources. The experimental arrangement, method of measurement, and calculations are reviewed. (D.E.B.)

11823 CF-52-2-12

Oak Ridge National Lab., Tenn.

HOMOGENEOUS REACTOR EXPERIMENT SHIELD DESIGN AND STEAM ACTIVITY CALCULATIONS. C. L. Segaser. Feb. 26, 1952. Decl. Feb. 14, 1957. 86p. Contract [W-7405-eng-26]. $0.60(OTS).

Preliminary estimates for the biological shield for the HRE indicate that reduction of over-all intensity of radiation from all sources within the shielding structure to biological tolerance within the process building may be accomplished by completely surrounding the equipment by at least 7 ft of Barytes concrete. A plan of the proposed equipment and shield arrangement which will accomplish the function of the shield is shown. In order to isolate equipment items within the shield by compartmentalization such that maintenance or replacement of these items is possible, the induced radioactivity of items within the shield must be determined. Calculations were made to determine saturation activities and resulting activities following shut-down after arbitrarily selected time intervals. Estimate or radioactivity of steam in the power circuit of the HRE is briefly reported. (J.E.D.)

11824 CF-52-5-40(Del.)

Oak Ridge National Lab., Tenn.

GAMMA DOSE BEHIND IRON–WATER THERMAL SHIELD OF VARIOUS THICKNESSES AS A FUNCTION OF WATER REFLECTOR THICKNESS. (Investigation for NDA.) C. E. Clifford. May 7, 1952. Decl. Mar. 19, 1957. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

SPECTROSCOPY

11825 WAPD-T-29

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

A HOLLOW CATHODE DISCHARGE TUBE AND HIGH VOLTAGE POWER SUPPLY FOR ROUTINE SPECTROCHEMICAL ANALYSIS. Neil E. Gordon, Jr., and Harold D. Cook. Feb. 21, 1953. 16p. $3.30(ph OTS); $2.40 (mf OTS).

The construction of a water cooled hollow cathode discharge tube and its associated power supply and carrier gas diffusion system for spectrochemical analysis are described in detail. The hollow cathode tube is so designed that rapid sample changes may be made. The output voltage of the power supply is continuously variable from 0.05 to 1 kilovolt at any current from 0 to 1 ampere. (auth)

URANIUM AND URANIUM COMPOUNDS

11826 A-3227

Johns Hopkins Univ., Baltimore.

THE U ISOTOPE EFFECT AND OTHER FEATURES IN THE ABSORPTION AND FLUORESCENCE SPECTRA OF URANYL COMPOUNDS. Final Report. G. H. Dieke. Mar. 23, 1945. Decl. Feb. 12, 1957. 174p. Contract [W-7405-eng-50]. Subcontract No. 36. $27.30(ph OTS); $8.10(mf OTS).

Work was undertaken in order to find the differences in the absorption spectra of uranium compounds when U^{238} is replaced by U^{235}, and utilizing this for a photochemical separation of the isotopes. Two substances, $CsUO_2(NO_3)_3$ and $Cs_2UO_2Cl_4$, as representatives of two types of compounds, were studied extensively. All results obtained during the project relating directly to the U isotope effect are presented. In addition work was done to clear up the structure of these and other uranium compounds and their spectra. (auth)

11827 IDO-16172

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MISCELLANEOUS SAFEGUARD CALCULATIONS. J. W. Webster and B. J. Garrick. May 26, 1954. Decl. Jan. 17, 1957. 10p. Contract AT(10-1)-205. $1.80(ph OTS); $1.80 (mf OTS).

Critical mass measurements were made for cylinders of U^{235} where the cylinder was bare, H_2O reflected, H_2O reflected with a Cd interface, and bare with a concentric Cd shell. The method of two-group, spherical geometry was used. (D.E.B.)

11828 K-1141

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.

WATER BOILER CALCULATIONS OF CRITICAL PARAMETERS. H. F. Henry and C. E. Newlon. Aug. 13, 1954. Decl. Feb. 23, 1957. 23p. Contract W-7405-eng-26. $0.25(OTS).

The U^{235} assay variation of the minimum critical U^{235} mass, volume, cylinder diameter, and slab height have been calculated for the water reflected case by use of the water boiler theory and using the current best values of the several nuclear constants of the water boiler equations. With respect to empirical criticality data reduced from experiments at 4.9% and 93.4% assays, the theoretic minimum U^{235} critical masses are considered to be slightly nonconservative and the calculated geometric parameters are considered to be conservative at the lower assay only. (auth)

11829 LAMS-967

Los Alamos Scientific Lab., N. Mex.

FABRICATION OF URANIUM WIRE. R. E. Anderson, J. M. Taub, and D. T. Doll. Oct. 25, 1949. Decl. Feb. 11, 1957. 37p. Contract W-7405-eng-36. $6.30(ph OTS); $3.00(mf OTS).

Experimental work for establishment of production procedures for U metal wire is described. Hot extruded U, high purity cast U and cast U^{235}, all $\frac{1}{2}$-in. rods, were used. Silver coating was chosen over Cu for ease of working and oxidation prevention. A satisfactory procedure was established in which Ag plated rod was cold swaged (room temperature was best) from 0.500 in. to 0.042 in. Final reduction was accomplished by wire drawing, using aquadag, down to 0.0033 in. for U and 0.010 in. for U^{235}. Anneals at 400°C followed each 75% reduction in area. U and U^{235} respond the same to fabrication. (T.R.H.)

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